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NAVAL INSTITUTE.

VOLUME XXV.

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EDITED BY GEO. F. COOPER.

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ANNAPOLIS, MD.

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In the numbers of the Proceedings of the Institute to be issued during the year will appear the following papers among others:

CABLE-CUTTING OPERATIONS DURING THE SPANISH WAR.
By Captain C. F. Goodrich, U. S. Navy.

THE BATTLE OF MANILA BAY.
By Lieutenant C. G. Calkins, U. S. Navy.

THE SYSTEM OF MESSING IN THE NAVY.
By Commander Wm. Swift, U. S. Navy.

THE COAST SIGNAL SYSTEM.
By Lieutenant F. B. Anderson, N. Y. Naval Militia.

SEAVEY'S ISLAND PRISON AND ITS ESTABLISHMENT.
By Lieutenant R. H. Jackson.
Prepared from facts obtained from Paymaster J. P. Loomis.

THE LOCATION OF CERVERA'S FLEET.
By Lieutenant Victor Blue.

A PAPER ON "WATCH QUARTER AND STATION BILL."
By Lieutenant-Commander Seaton Schroeder.

The aid of members and friends of the Institute is solicited in increasing interest in its work.

THE PROCEEDINGS

OF THE

United States Naval Institute.

Vol. XXV., No. 1. **March, 1899.** **Whole No. 89.**

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ST. LOUIS AS A TRANSPORT.

By Captain Caspar F. Goodrich, U. S. Navy.

The exceptional credit won by the U. S. S. St. Louis in the transportation of troops during the late war with Spain is due to several concurrent circumstances.

In the first place, her commanding officer, the writer, had, in 1882, made a trip on board of a chartered trooper in the Tel-el-Kebir campaign under General Sir Garnet Wolseley, and he had studied the question of how British soldiers are conveyed in merchant steamers hired for the purpose and temporarily equipped. He had but to recall a former most interesting and valuable experience and to consult the official report on the subject to recognize the imperative necessity of making certain preparations and of establishing an orderly method of procedure in advance. Of these preparations, adequate water closet accommodations are first in importance. Twenty men to one hole is a barely comfortable but not luxurious ratio; over fifty men to one hole is a ratio bordering on the distressful. About a dozen extra seats were provided in the St. Louis to reach the former proportion.

Secondly: In the design of the St. Louis thoroughly complete arrangements had been made for the reception and care of seven hundred and odd emigrants. If the troops to be carried did not exceed that number, practically nothing was needed in the way of fittings.

Thirdly (and this is a most weighty consideration): The organization and routine of the ship as a trans-Atlantic liner had been retained—unaltered in any particular. If the soldiers could be regarded and treated, in the main, as steerage passengers, the personnel of the vessel would encounter no new or unsolved problem. It would indeed be doing afresh what it had already done scores of times.

Fourthly: The St. Louis had just brought north, as prisoners, Admiral Cervera, a lot of his officers and men (about seven hundred in all), had had no untoward occurrence on the voyage, had nursed a hundred and fifty sick Spaniards and had landed safely in the United States every man who had come on board in Cuba. The experience was both recent and useful, singularly opposite, indeed, to the next duty she was called upon to perform.

Fifthly: The chief officer under the old régime (who later received, by the way, a temporary commission as lieutenant in the United States Navy) was a man of unusual ability and energy. Fortunately, also, he had the details of the British method of moving troops by heart, having many times served on board of chartered merchant steamers employed in this special service. My indebtedness to Lieutenant T. G. Segrave is very great. I am glad of this public opportunity of acknowledging the obligation.

Lastly: In Commander W. G. Randle, U. S. Navy, previouly and now again the Commodore of the American Line, and in his subordinate officers of the St. Louis, I had a set of capable, zealous, courteous and untiring associates who seemed the happier for each new demand upon their time and powers. I can wish no one greater good fortune than to command so fine a ship and to have her manned by such ready, trained and resourceful officers, seamen, engineers, and stewards as served with me last summer. I am thus frank in detailing the advantages under which I labored, because I think it would be unfair to claim that the conditions were in the least normal. I may add that, having at my disposal extraordinary facilities for the work to be done, I also had the wit to adopt and utilize them without change.

On receiving directions to be ready to take troops from Hampton Roads to Porto Rico, I naturally did everything in my power to have the orders changed and to save the ship from what seemed to us all so ignoble a fate. My efforts were in vain. In the meantime I requested the officers attached to the St. Louis to submit to me written suggestions as to the preparations to make for receiving and caring for the soldiers; also as to the rules to be established for the control and discipline of so large a body of men. In these suggestions Lieutenant-Commander N. J. K. Patch was both fertile and helpful. I may here remark that the St. Louis was operated on mediæval lines, there being a navigating branch; the original merchant steamer organization with Captain Randle and his chief officer at the head; and the military branch to work the battery, consisting of some forty-odd marines under Lieut. A. W. Catlin, U. S. M. C., also Ensign F. R. Payne and some naval cadets of the present third class at the Naval Academy, the whole presided over by Lieutenant-Commander Patch. Quite a story might be told of how this ancient idea worked in the nineteenth century.

The recommendations of the officers of the St. Louis were then considered by me, and Mr. Segrave's fund of information drawn upon to a large extent. The result took definite shape in the following instructions, which were printed in large clear type and issued, one copy to each officer serving with the troops expected, and one to every other officer who, on account of his duties, etc., should have knowledge of them:

Instructions to Troops, U. S. S. St. Louis.

All stores, baggage, etc., to be sent down to the ship at least one day in advance of troops, and four days' rations to be stored in ration room.

Troops to be supplied with one day's rations before embarking.

A full list of officers, the number of men and distinguishing letters of each company, also a list of officers' servants to be supplied to ship as soon as possible.

Each servant will be supplied with a distinguishing badge to be worn at all times.

Troops to be marched on board in companies, to stow their rifles in port lower steward's quarters, (*a*) and then to be marched to the section prepared for them and bearing the letter of that company—each section will be marked with company letter and regiment.

Twenty men will be appointed to serve out rations; no others will be allowed in ration room.

An officer of the day will be detailed by the officer in command of the troops. He will be responsible for the behavior of the men, cleanliness of quarters, etc., and will report any irregularities to the chief officer.

One officer will be detailed to take charge of each compartment allotted to troops for the purpose of maintaining cleanliness and order, and will see that his compartment, w. c.'s, etc., are ready for inspection by 10.30 A. M.; he will be held responsible for same to the officer of the day.

An officer will be with each company when rations are being served out.

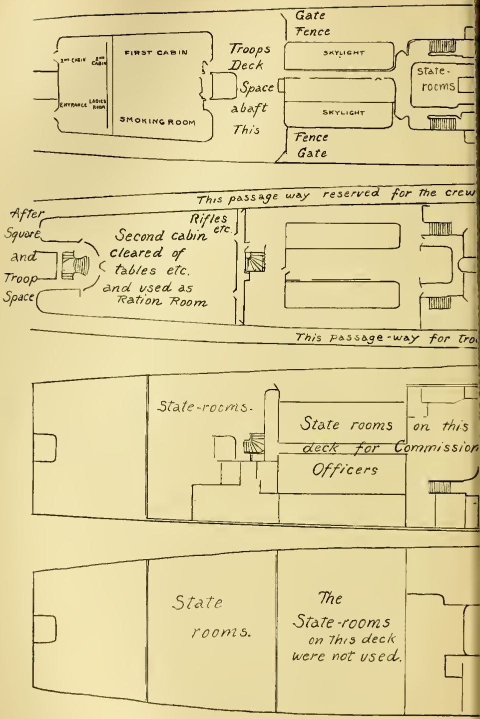
Four night officers will be detailed who will relieve the officer of the day and be responsible for the behavior of the men during the night. They will make a complete tour of inspection through the compartments every two hours, accompanied by an officer of the ship, and report any irregularities to the chief officer.

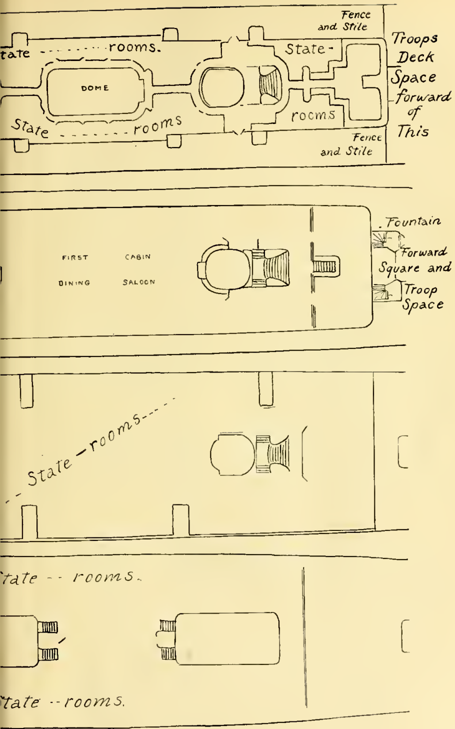
Reveillé to be sounded at 4.30 A. M., when the men will roll up and stow their beds and come on deck, where they can have the use of the hose until 5.30.

The first mess-call will be sounded fifteen minutes before meal hours and will be for mess formation, when the men in each section will fall in under their company officers, and at the second call the men of the forward sections will march along the port alley way, pass through the passage on the fore end of the ration room, receive their rations and return to their sections through the starboard alley way. The men of the after sections will pass through the port after entrance, receive their rations at the after end of the ration room and return to their sections through the starboard door (*b*).

First call will be sounded at 9.30 P. M., and taps at 10 P. M., when all the men will be in their quarters for the night (*c*).

Each section and each w. c. will have the company letter and regiment (*d*) painted on it so as to avoid confusion, and notice boards will be placed in different parts of the ship to facilitate the movements of the troops (*e*).


Gate
Fence
FIRST CABIN
1ST CABIN
2ND CABIN
ENTRANCE
LADIES ROOM
SMOKING ROOM
Troops Deck Space abaft This
SKYLIGHT
SKYLIGHT
State-rooms
Fence
Gate
This passage way reserved for the crew
After Square and Troop Space
Rifles etc.
Second cabin cleared of tables etc. and used as Ration Room
This passage-way for Tro
State-rooms.
State rooms on this deck for Commission
Officers
State rooms.
The State-rooms on this deck were not used.



Fence and Stile
tate rooms.
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State rooms
Troops Deck Space forward of This
Fence and Stile
Fountain
FIRST CABIN
DINING SALOON
Forward Square and Troop Space
State - rooms
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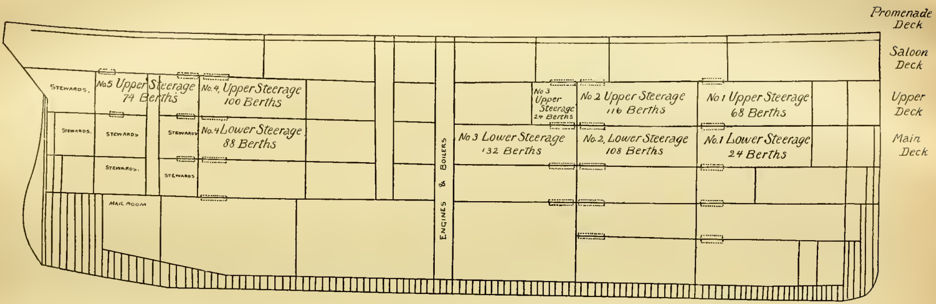

U. S. S. ST. LOUIS.

STEERAGE SPACES: 68 + 24 + 116 + 108 + 24 + 132 + 100 + 88 + 74 = 734 Berths.

Drinking water will be supplied from a fountain in each square (*f*).

MEAL HOURS, ETC.

Reveillé at 4.30 A. M.
Washing, 4.30 to 5.30 A. M.
Mess formation, breakfast, 5.30 A. M.
Second call, 5.45 A. M.
Inspection 10.30 A. M.
Mess formation, dinner, 11.15 A. M.
Second call, 11.30 A. M.
Mess formation, supper, 4.15 P. M.
Second call, 4.30 P. M.
Troops go below, 9.30 P. M.
Taps, 10 P. M.

DECK SPACE FOR TROOPS.

On promenade deck, from fore part of deck house to bow, and from after part of deck house to stern, also starboard side of saloon deck and after square, also in fore square as far as troops' quarters.

No smoking allowed in compartments. Troops not allowed, under any circumstances, in crews' quarters.

Hospital will be supplied for troops in the forward and after squares, and a dispensary and surgery on starboard side of after square.

An examination of the accompanying plans will show the general disposition of the ship's spaces available for troops.

The bulkheads and bunk fittings were removed from the steerages (compartments or sections) on account of the high temperature expected and of the better ventilation which their absence would secure.

(*a*) The rifles and accoutrements were stowed in one corner of the second saloon (converted into a ration room) instead of in stewards' quarters as contemplated.

(*b*) The serving out of rations was arranged in expectation that the food would be cooked. As the military authorities decided that the men should have cold meals, a detail of men from each company formed in the port passage way, and passing through the end of the ration room from port to starboard, received the cans of meat, vegetables and biscuits and took them to the troops' quarters for division. This operation was quickly performed in an orderly manner.

On my undertaking to prepare hot coffee for the soldiers, a similar disposition was made, except that all the men attended in person, each man coming from port to starboard by the ration room door would dip up a pot full of coffee already sweetened and pass on. Thus each got his proper ration.

(*c*) The weather grew so warm after crossing the Gulf Stream that the troops were allowed to sleep on deck but always in that part allotted to them.

(*d*) Inasmuch as but one regiment embarked, the company letters sufficed.

(*e*) At every limit of the troops' space large white sign boards, about four feet long and proportionately broad, were displayed, bearing legends in black like this: "TROOPS NOT ALLOWED FORWARD OF THIS," or "TROOPS NOT ALLOWED ABOVE THIS," etc. Marine sentries were posted at these points to enforce the order. Much wandering in forbidden places was avoided by these unmistakable directions.

(*f*) The spaces under the forward and after ends of the promenade deck, called squares, corresponding to those under poop and forecastle, were largely given over to the troops.

On the deck in the steerages and squares billets were marked out and numbered, 802 in all. Had the troops been kept down to this figure every man would have had his own sleeping place, but as 1300 came, crowding in proportion was unavoidable.

The officers were assigned first-class cabin rooms on the upper deck, so-called—that immediately below the main saloon. Not more than two were in any room and the seniors very generally had a room each.

The promenade deck rooms were already occupied by the officers attached to the ship and by other naval officers on board for passage.

The army officers messed in the saloon, their seating being fixed by Major-General Brooke. They paid the same mess bill which had been exacted of the Naval Cadets who had gone to Santiago in the transports which conveyed General Shafter's Fifth Corps. The bill of fare was practically that which passengers of the first-class enjoy in going to Southampton in steamers of the American Line.

It was very important to get all the baggage, stores, ammunition and provisions on board and in place before a single soldier was admitted. Yet this obvious precaution demanded my unremitting vigilance, and caused me, I fear, to be unkindly regarded by some who wished to be first to arrive and to settle down. The only exception to the rule was forced upon me by the arrival, late one evening, of a sick officer and his attendant surgeon.

The articles of luggage needed for the trip, having been so marked in advance, were placed in the cabins of their owners, the heavy stores, etc., put in the hold, while the provisions for the voyage and the ammunition sufficient for the first landing were taken into the ration room. When all this was done, the ship was ready for the troops.

They came down to Hampton Roads from Newport News on large railroad flats which made fast alongside. The troops fell in by companies on the flats, marched up the gangway, through the ration room, where they deposited their arms and accoutrements, then proceeded to their sections (under guidance of sailors from the ship), where they remained until the last man was in his place on board. Then the bugle sounded and they were free to roam about within their prescribed bounds. In one hour and fifty minutes the 1300 men were embarked and ready for the voyage without confusion of any kind. The weather being hot, the waiting below was extremely irksome but it was essential to good order and discipline; otherwise the deck would have been encumbered by a crowd of people.

To the spaces shown on the plans the troops were rigidly confined. Not a man was permitted outside—especially were none allowed on the shade or uppermost deck of all where the boats were carried.

Every day the officers were requested to temporarily vacate one side of the promenade deck that a company of soldiers might be exercised without arms—more for the purpose of maintaining discipline than of perfecting their drills.

Besides the Third Regiment of Illinois Infantry, the St. Louis took from Hampton Roads to Arroyo, Porto Rico, Major-General Brooke and his staff. I count it a privilege to have had the company of so excellent a soldier and so charming a man on this unusual trip. His penetrating insight into the necessity for the rules formulated and his sympathetic aid in maintaining discipline and promoting harmony will not soon be forgotten. I must say that co-operation with the Army was rendered by him an unalloyed pleasure.

A careful inspection of the troops' quarters was made at 10.30 A. M. daily by me, accompanied by the Chief Officer, the Purser, the Surgeon, the Chief Steward and, of course, by Lieutenant-Commander Patch. On at least one of these occasions General Brooke was good enough to accompany me.

It was not easy to make the volunteer soldiers take as good care of their sections as could have been wished, for some seasickness joined to natural indifference to thwart our intentions, but, in the main, I think they deserve credit. Possibly regulars under regular officers would have done somewhat better than volunteers on board the St. Louis even if they did less well elsewhere. There were no cases of disorder on the passage.

The officers lived on the promenade deck between the troops' limits, when not at their meals or in their bunks. The majority were extremely appreciative of the efforts made by all attached to the St. Louis to render them comfortable. Some there were, as might have been expected, who, through ignorance, regarded the captain as responsible for the high temperature which prevails in the tropics, for the disorder of their cabins which were attended to by their own servants, or for lack of the many saloon and deck stewards who swarm on board a trans-Atlantic greyhound. With three square meals a day of fresh food well cooked, with all the luxuries which could possibly be produced on board an auxiliary cruiser, and vastly more than could have been expected, with ample deck room for lounging and smoking, a scrupulously clean ship and comfortable cabins, as cool as the best ventilating plant afloat could render them, their lot was enviable in every respect.

The troops came on board in Hampton Roads on July 28th and were landed at Arroyo, Porto Rico, on August 2d and 3d. The subjoined letter from Major-General Brooke shows the manner in which the preparations and rules worked in actual practice.

Headquarters First Army Corps,

Arroyo, Porto Rico, August 3, 1898.

Captain C. F. Goodrich, U. S. Navy, U. S. S. St. Louis.

Captain:—I cannot refrain from expressing to you my gratification at the complete and comfortable arrangements which were made on board your ship for the transportation of my Headquarters and the Third Illinois Infantry from Fortress Monroe to this point. The uniform courtesy and consideration shown by yourself and officers will always be a pleasant remembrance of this time of war.

Trusting that all your future may be as bright and pleasant as your eminent qualities deserve, I am,

Very truly yours,

(Signed) John R. Brooke, Major-General.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SKETCHES FROM THE SPANISH-AMERICAN WAR.

By COMMANDER J——.

(Translated from the Marine-Rundschau, October, November and December, 1898.)

INTRODUCTORY.

During the recent war the German protected cruiser Geier, Commander Jacobsen, was stationed in the West Indies, in the vicinity of Cuba, and was permitted to pass in and out of the blockaded ports. There has lately appeared in the Marine-Rundschau, of Berlin, an official publication, a series of "Sketches from the Spanish-American War, by Commander J——." Their translation complete is given in this number of the War Notes.

RICHARDSON CLOVER,
Commander, U. S. N., Chief Intelligence Officer.

NAVY DEPARTMENT, *January 16, 1899.*

Approved:
A. S. CROWNINSHIELD,
Chief of Bureau of Navigation.

The following considerations constitute the opinions of the author as acquired by him on the scene of war. He wishes to call special attention to the fact that until authentic data are available as to the strength of the two opponents in the different battles, the tactical situations and intentions, and the losses in personnel and material, the reports can be but incomplete. Nevertheless it will be desirable, even without awaiting official statements, which may not be published for years by the two belligerent parties, to sift the confused mass of material which has come to us through the newspapers and to try and describe the most important operations, at least approximately, as they have taken place. To that end I have partly made use of reports of Germans who were eye witnesses of the events. It is hardly necessary to emphasize the fact that the author has observed the strictest impartiality in his estimates of the situation. He has the same high regard for Spanish and Americans.

I. The Cause of the War.

1. Much has been said and written about the cause of the war; but, even at the risk of offering nothing new, I believe I ought not to avoid entering into this question, in order to make the sketch complete.

As early as 1890 Mahan's sharp eye discerned what course the politics of his country ought to follow, and in vigorous language he pointed out that course to his nation, from a military standpoint, in his essay entitled, "The United States looking Outward," and in 1893 in "The Isthmus and Sea Power." But not only strategic interests, commercial interests also, play a powerful part in this historical drama. Almost nine-tenths of all the sugar from Cuba is already going to the American market. If America succeeds in getting Cuba into her hands, either by autonomy or by annexation, it will insure an immense advantage to the American market and drive all other kinds of sugar (Germany is interested to the extent of many million marks) entirely out of America. Moreover, only a small part of Cuba is as yet being cultivated, and there are good prospects for harvesting from this beautiful country immense wealth in sugar and tobacco. Upon calm consideration it is therefore not astonishing that the Government of the United States, pressed by the wishes of the people and by speculators having only their own interests in view, should finally have yielded and resolved to lay aside the peaceable attributes of commerce and industry and take the sword in hand. It should further be mentioned that the Maine affair threw the last spark into the powder barrel, and that the conduct of American officials at Havana toward the Spanish officials subsequently added further fuel to the flame.

The United States of America has done what other nations in its place might perhaps have accomplished long ago. According to the old adage that a war arises out of the needs of nations, the Union has taken advantage of the opportunity to secure for herself the first place in the West Indies.

2. Very different from the United States, the power of the Spanish Empire, which at one time ruled the world, has been gradually undermined. The flourishing colonies of Cuba, Puerto Rico, the Philippines, etc., have suffered severely during the last few years from fanatic conflicts between the inhabitants and Government troops as a result of the injudicious policy followed in the government and treatment of the former. Owing to the corruptibility of the officials, fostered by the merchants, the actual revenues from the colonies never reached the hands of the Spanish Government. The principle of the Spanish to compensate themselves first of all out of the rich profits of the country has brought about the catastrophe. It was precipitated by the fact that repeated changes in the highest positions were approved by the Government at Madrid, which necessitated not only a change in the majority of the lower officials, but entailed an entirely new system of oppression and systematic robbing of the inhabitants. When the Government at last realized the true state of affairs it was already too late. Blanco, the last Captain-General and Governor of Cuba, as well as Martinez Campos, are well known as men of unimpeachable character. But although General Blanco had an intimate knowledge of Cuban conditions and enjoyed great popularity, he did not succeed in stopping the rolling ball. Steadily it was approaching the abyss, and even the autonomy proclaimed by the Government could not save it from the catastrophe. That catastrophe was the war with the United States. The Spanish, it is true, consider it an entirely unwarranted interference with rights that have been theirs for centuries and an act of violence on the part of a neighboring nation. But that is a characteristic of the Spanish nature and will serve to explain subsequent situations during the war. Even up to the very last day Spain thought it utterly impossible that war could break out with the United States. This is proved by the conditions in Cuba immediately after the sending of the ultimatum by the United States and the rejection of the same by the Spanish Government.

If the Spanish had not been so blinded, and had had eyes for what was going on in their immediate vicinity and in the country of their powerful neighbors during the last few years, they could not have hesitated to set aside their pride, and even to give up their right to the colonies. The United States would have paid Spain a handsome sum for the Atlantic colonies. The Spanish army, which had been fighting for years with great valor and under endless privations, would have honorably returned home, the Spanish merchants would have continued their business under safe protection, and the purchase price would have helped the mother country in her financial troubles. That would have been practical. But fate and the obstinacy, or rather the pride, of the Spanish willed differently. The ball keeps on rolling, and nothing will stop it until the Spanish power is deprived of its colonies and, utterly broken, without any prospect for the future, retires to its exhausted mother country. But that will not prevent the people from proudly raising their heads and exclaiming: "We have defended our honor and have fought trusting in our just cause. Ours is the glory!"

3. Thus the struggle for existence is ever the same, even as between modern nations. And each country which, by reason of its commerce and industry, is entitled to a voice in the politics of the world, should learn a serious lesson from this struggle between capital and antiquated heroism. Germany, above all, should never forget that nothing but a naval force will keep her safe from adversaries—a naval force strong enough to guarantee, or at least not to preclude, success under all possible circumstances.

II. The Belligerent Parties.

4. I will not go into particulars as to the formation and strength of the belligerent parties, as this work is not intended to discuss the course of the whole war, but merely to select a few important and interesting events. Besides, the reader will have an opportunity of gaining information on these points by many other discussions on the subject. There has lately appeared in the Marine-Rundschau a review on the events of the Spanish-American war, giving the strength of both parties, together with a discussion by Rear-Admiral Plüddeman, which is especially well adapted for that purpose. I shall take the liberty, however, of inserting a few remarks as to my personal observations while on the scene of war.

5. As the United States of North America does not constitute a military nation and has troubled itself very little about the organization of militia and volunteers, it would not be proper to make the same requirements of American soldiers that we are in the habit of making of our soldiers in Europe. Preparatory training need not be looked for, except in the case of regular troops, and even there such training in time of peace is very defective. The companies of militia and volunteers are drilled for a short time; officers and men become acquainted with each other, and as soon as an officer is able to lead his company or division and the men have learned to handle their guns, which is at most four weeks, the troops are considered ready for war.

This system naturally precludes the exercising together of large bodies consisting of several regiments. First of all, trained officers are lacking for that purpose, and besides, it is not deemed necessary. These troops do not fight, like European armies, in close ranks, but rather on the order of guerrilla warfare. It will be readily understood that under such circumstances there can be no question of great discipline under fire or in camp on the part of the men, nor of high tactical conceptions and corresponding leadership on the part of the officers. It is very praiseworthy, therefore, that with such primitive means such great results were attained as evidenced, for instance, by the capitulation of Santiago. As for the individual qualities of the American soldier, he is brave, too impetuous perhaps, and as long as there is fighting to be done and the hardships are not too great he is easily guided. A few volunteer regiments fought with considerable valor. But not in that respect alone have they shown military efficiency, but also in the manner in which they have endured fatigues in the extremely unfavorable climate. I am probably not mistaken in the assumption that the good results attained by some of the volunteer regiments are partly due to the circumstance that outdoor sport is carried on with great zeal in the United States. Polo, football, athletic exercises in running, walking, and jumping, tennis, bicycling, rowing, etc., are excellent preparations for military service, because they harden the body and strengthen self-confidence. And if the volunteers further know how to handle their guns and are good marksmen, which is also included among the sports, they have very nearly all the qualities which the Americans require of their soldiers.

6. The United States Navy has been diligently at work ever since the war of the rebellion, 1861 to 1865, and has put to profit the lessons derived therefrom. That the American naval officers are intelligent and energetic as well as brave and self-possessed leaders, and the American sailors cool-headed and good marksmen, was demonstrated by many examples during the above-mentioned war. The naval battle between the Kearsarge and Alabama, such deeds as Farragut's at Mobile, will never be forgotten and go to prove that the first foundation for a warlike and efficient navy—an able personnel inured to the sea—was in existence. Nor does the Union need fear a comparison with other nations as far as matériel is concerned. Since the year 1888 it has been the endeavor of the Navy Department to take the construction of ships, armor plate, and ordnance into its own hands, so as to render itself entirely independent of other countries in that respect. The inc·ease of the fleet has kept pace with such efforts. The battle-ships Iowa, Indiana, Oregon, and Texas possess all the requirements of modern ships. Their heavy artillery is unusually strong, and the medium and light artillery consists of rapid-fire guns in larger numbers. The new armored cruisers New York and Brooklyn are fast and powerful ships, entirely on a level with the same class of cruisers in England and France. It cannot be denied that a certain weakness regarding the personnel lies in the fact that so many different nationalities are represented on board; but I believe this circumstance is not of very great weight. Europeans are too much inclined to see everything only with their own eyes and judge matters according to their own usages. On board of a ship, where very strict laws prevail, especially in time of war, it cannot be difficult, even among mixed nationalities, to maintain the necessary discipline as long as the officers have a correct understanding of how to handle the crews, and that faculty the American naval officers do possess, as has already been stated. Moreover, the reports of the Naval War College at Newport show that it is the endeavor of the Navy Department to have the officers gain also the necessary knowledge of tactical and strategic questions. During the last few years fleet maneuvers have taken place, the training of the crews has been carried on in a systematic manner, and, finally, target practice has been given the importance which is absolutely necessary for the attainment of the final end, namely, the annihi-

lation of the enemy in war. I do not want to be misunderstood and do not mean to give the impression that the American Navy is above all censure and should be taken as a model in every respect. Not at all. Many weaknesses have come to light everywhere. I will only call to mind the taking off of the armor plates of the Iowa, several faulty gun constructions, which are withheld for publication. And the boilers were probably not free from objections either. But in what navy are such defects not found? It is therefore deserving of sincere praise that the Navy, immediately after the breaking out of hostilities, was ready for service with all the ships in commission and has continued such service successfully for several months. Furthermore, the vessels of the merchant marine which were required for the blockade were fitted out and armed with rapid-fire guns in a very short space of time. This latter circumstance especially might well serve as an example to several other navies.

7. As compared with the United States, Spain has a large regular army. But when we remember that so many colonies have to be defended and that the struggles with the insurgents, which have been going on for years, and the hardships connected therewith, have claimed many victims, the importance of this army shrinks considerably. It should further be remembered that the troops in Cuba and Puerto Rico are distributed along the coasts for protection and that communications between them and concentration of these troops by railway are possible only in few places. Hence it can hardly be said that the Spanish troops are superior to the American fighting forces as far as strength is concerned. As to their military qualities, the Spanish soldiers are highly thought of everywhere. They are very brave, of great power of endurance, always sober, and extremely frugal. The officers present a good military appearance, but their education is said to be superficial. Their patriotism and readiness to sacrifice themselves cannot be questioned. Moreover, officers and men have become inured to warfare through their fights with the insurgents and are acquainted with the difficult topography of the country. Outside of the regular army, volunteer regiments have been organized everywhere. To see those people of all conditions and ages devote themselves indefatigably to the duties of their new calling, after their regular day's work is done, cannot fail to arouse a feeling of admiration. But, on the other

hand, it is questionable whether the volunteers, when it comes to actual fighting, will prove efficient. In the first place, their equipments are very defective, and, besides, their training is not sufficient to fit them for war. It may be stated as a general thing—and this applies to the regular troops as well—that the training is not adapted to war purposes. I witnessed, for instance, a drill of coast artillery where the movements of loading and firing were practiced. Projectiles, cartridges, etc., were lacking at the drill. The guns were not aimed, there was no sighting. That was one day before an actual bombardment occurred at that place. It is very evident that such gun crews cannot do very efficient work. In only a few of the coast towns did target practice take place, and then only to a very limited extent. The reason was, as I was told, that ammunition was scarce, as the service ammunition had to be reserved for the enemy. That may be true, but this should have been thought of in time of peace, and this most important preparation for war should not have been deferred to the last minute or omitted altogether.

8. The Spanish Navy has never recovered since the beginning of the century, when it was completely annihilated. To illustrate, I will quote Nelson's words after a visit to Cadiz in 1793: "The Dons may know how to build beautiful ships, but they do not know how to procure men. At Cadiz they have in commission four battle-ships of the first rank, very beautiful ships, but miserably manned. I am quite certain if the crews of our six boats, who are picked men, had boarded one of these ships, they could have taken it." Mahan, in his work on The Influence of Sea Power upon History, 1783 to 1812, Chapter II, has cited a number of other proofs to show the lack of seamanship on the part of the Spanish. The above-mentioned words of Nelson's are still true. A few handsome ships like the Almirante Oquendo, Vizcaya, and Infanta Maria Teresa have been incorporated into the Spanish Navy, but next to nothing has been done for the training of the personnel. Maneuvers of several fleets together were unknown, and the individual training of officers and men was limited to what is absolutely necessary. Especially as relates to target practice much has been left undone. The same thing applies to the torpedo-boat destroyers which the Spanish have secured during the last few years. The vessels were very beautiful, but no thought was taken of the manner in which they should be handled

by their commanders, nor the training in tactics and torpedo launching. As to the condition of the ships generally, I will state, among other things, that the boilers of three cruisers of the same class, the Reina Mercedes, Alfonso XII, and Reina Cristina, were in such bad condition as to completely disable the vessels, so that they could be utilized only for harbor defense. There are several other points which also show carelessness in the training of the personnel as well as equipment of the ships, and to which I will again refer in the course of this work.

III. Bombardment of San Juan de Puerto Rico.

9. It was on May 9, 1898, that I had an opportunity for the first time of visiting the scene of war; that was at San Juan de Puerto Rico. The first thing that caught my eye was a proclamation by the Governor-General Macias. As this proclamation shows the enthusiasm and patriotism of which the Spaniard is capable to such a high degree, I give below a translation of the same:

San Juan, *April 23, 1898.*

Inhabitants of Puerto Rico:

The day of trial, the hour of great decisions and great deeds of heroism has arrived. The Republic of the United States, trusting in her powerful resources and relying on the impunity with which she has so far been able to foster the insurrection of the Cubans, has resolved in her Congress upon armed intervention in the island of Cuba. The Republic has opened hostilities and has trampled under foot the rights of Spain and the moral sentiment of the whole civilized world. This is a declaration of war, and in the same manner that the hostile squadrons have commenced their actions against the island of Cuba they will also direct them against Puerto Rico; but here they will surely be shattered against the loyalty and valor of the inhabitants, who would a thousand times rather die than surrender to the usurpers.

Do not think that the mother country has abandoned us. With enthusiasm she is following our movements and will come to our rescue. The squadrons are ready for the fight. All the troops have been armed, and the same waters over which Columbus sailed with his famous ships will witness our victories. Providence will not permit that in these countries which were discovered by the Spanish nation the echo of our language should ever cease to be heard, nor that our flag should disappear from before the eye.

Inhabitants of Puerto Rico, the time for heroic deeds has come. Fight and stand firm in the consciousness of your right and of justice. On to the war!

Long live Puerto Rico, always Spanish! Long live Spain!

Macias.

It seems to me that more beautiful and more eloquent words could hardly be found to speak to the hearts of the people. And unless the actions and deeds of the leaders fall far short of their words, the American invasion may be prepared to meet with strong resistance.

10. The city of San Juan is located on an island, and presents from the sea a very pretty picture with her ancient castle of Morro on one side and San Cristobal Castle on the other. The forts are powerful masonry structures. Between them rise many stately buildings, mostly barracks, hospitals, etc. The Spanish flag is waving from all the buildings, and lends a picturesque charm to the whole scene in the wonderfully bright light, with chains of mountains as a background.

Besides the old forts there are a number of new fortifications, east of Cristobal Castle as well as in the entrance of the harbor itself. The latter, which is difficult to pass even in time of peace, is closed by mines. After passing through the harbor entrance one enters a large basin close behind the city, adapted to receive a large number of ships. There is also a second bay with sufficiently deep water. With the necessary funds the harbor might be greatly improved by dredging, especially by the removal of at least a part of the shoals at Punta Larga. There are quite a number of piers offering good facilities for loading and unloading ships.

11. In consequence of the breaking out of the war with the United States commerce was, of course, at a standstill. Yet as the harbor had not been declared blockaded there were a few German and English steamers that were unloading their cargoes. A Spanish steamer also had been brought in from St. Thomas by the auxiliary cruiser Alfonso XIII. The only vessel that behaved in a suspicious manner, having apparently passed around the whole island several times and repeatedly appeared in front of San Juan, was a large ocean steamer with three smokepipes. The general opinion was that it was a United States auxiliary cruiser. The Spanish gunboats tried several times to go close up to this vessel but did not succeed, owing to her superior speed. Nothing else in the city reminded one of war. Every one was pursuing his accustomed occupations as far as this was possible under the circumstances. Almost every evening after the close of business at 5 o'clock the volunteer companies


MORRO CASTLE
San Cristobal Castle.
Cabras Is.
Canuelo Ft.
Bayamon River
Sn. Augustin Bat.
Arsenal
Carban Is.
Antonio Canal
Manglar Is.
Miraflores Bay.
Ft. San Geronimo
Ft. San Antonio.

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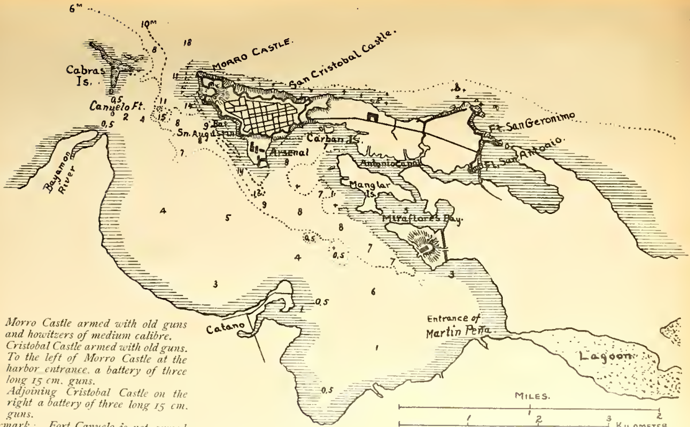
Port San Juan (Puerto Rico)



1. *Morro Castle armed with old guns and howitzers of medium calibre.*
2. *Cristobal Castle armed with old guns.*
3. *To the left of Morro Castle at the harbor entrance, a battery of three long 15 cm. guns.*
4. *Adjoining Cristobal Castle on the right a battery of three long 15 cm. guns.*

Remark: Fort Canuelo is not armed.

marched through the streets to the place where they were drilled. There was not much done in that line, however, at least nothing of great importance, such as target practice, instruction in topography, or field service. Usually the troops were required to take their positions in the line of defense, and soon after they would march off again. On the whole, the volunteers made a good appearance and seemed to devote themselves with great zeal to their tasks. The large number of young men among the volunteers was striking. On one occasion the Governor-General made a general inspection of the whole fortification, and at that time exercises took place with several batteries. But the exercises were carried out in a careless manner and without system. Target practice with guns, which would have been necessary above all in order to place the fortification in condition for war and to drill the personnel, was held neither in peace nor after the breaking out of the war. In the evening the whole population would usually repair to the plaza; several times during the week there was music there. The theater also remained open and enjoyed pretty good audiences.

12. This peaceful situation was suddenly changed when, on May 12, 1898, a part of the fleet commanded by Admiral Sampson appeared at 5 o'clock in the morning in front of San Juan, and without any further notification opened the bombardment. The Spanish complained bitterly of this surprise, which did not give them a chance to remove the sick and the women and children to places of safety, and did not give foreign representatives and warships time to leave the city or the harbor. "There are no international agreements, it is true, as to previous notice of a bombardment," says the Puerto Rico Gazette, "but in practice the custom prevails among all civilized nations to give notice of the bombardment of a city or fortification. For no Christian soldier, no civilized nation, will want to take the terrible responsibility of butchering defenseless women and children. The soldier fights against those who carry weapons, but not against the weak and the sick." The Spanish are not entirely wrong in this. A real surprise could have been of advantage to Admiral Sampson only in case it had been his intention to force the harbor. If it was simply a question of reconnoissance, he might have granted a delay of two or three hours without in any manner prejudicing the result of the bombardment. As it was, the inhabitants were

rudely awakened from their sleep. The troops and volunteers at once hurried to their posts; but old men, women, and children sought their safety in the fields and roads outside of the city. A veritable emigration of fleeing people was moving along the road to Cangrejos, but all were quiet and orderly. Meanwhile the American projectiles were steadily falling upon the city and its vicinity; some passed over the city and fell into the bay.

13. The American squadron was composed of nine larger ships and two torpedo-boat destroyers. Fire was opened immediately after 5 o'clock and continued until about 8.30. Four of the American ships were about two cable lengths (370 meters) north of the island of Cabras (see accompanying chart), and at equal distances from each other they were describing circles. In order to safely avoid the shallow places near the island, which they passed at a short distance, a boat had been anchored in the center of the circle. They came to within 1500 meters of the Morro, and as each ship passed the castle she fired a broadside. Five of the American ships were fighting farther north with Cristobal Castle and the eastern batteries of Morro Castle. These ships often changed their positions. Two more ships could be discerned northeast of Santiago. Several of the American ships succeeded in passing so close to the fortifications that the nearest batteries could not fire upon them. The distance was probably 800 or 900 meters. The Spanish infantry took advantage of the opportunity to join in the battle with musket fire. This musket fire, in connection with the fire of a battery at a greater distance, caused the American ships to withdraw. It is said that the Americans fired in all from 800 to 1000 shots from their heavy and medium-caliber guns.

14. The Spanish fortification artillery is said to have behaved well; but the batteries were unable to answer the lively fire of the American ships in the same manner. This was due to the fact, aside from the defective service of the guns, that many of them could not reach the American ships at all. On the Spanish side about 400 projectiles were fired in all. It is stated that the Spanish shots hit in several instances; but they can have done no great damage on board of the American ships, which has been confirmed by United States official statements. The guns in the fortifications are all of medium caliber, and their piercing power is not such that a single hit could be expected to cause

serious injury to a modern ship. The losses on the American side were one dead and seven wounded. The number of American projectiles fired is out of proportion to the material damage caused by them. A large number of shells are said not to have exploded. Of course the fortification works were injured to some extent, but not one of the guns was put out of action. A few of the buildings visible at a great distance, like the barracks, the jail, the Hotel Inglaterra, and a few private residences, suffered from the bombardment. A large number of projectiles fell into the harbor. Some of them even reached the little town of Cataño, on the other side of the harbor. The French cruiser Amiral Rigault de Genouilly, which was lying in the harbor at the time, as also three small Spanish gunboats, received a shot in the rigging and smokepipe. The Spanish casualties were 20 dead (among them several civilians) and 20 wounded.

15. If we inquire into the advantages which Admiral Sampson expected from a bombardment of San Juan, we are probably not mistaken in the assumption that it was merely a question of reconnoissance. The batteries were to be brought out; Admiral Sampson wanted to ascertain their strength and efficiency and be guided thereby in determining the forces it would require for a serious bombardment of San Juan and the taking of the city by sea. It does not appear to have been the object of the American ships to systematically bombard the city and silence the batteries. Probably the forts served as a general target, and the number of shots that went beyond speak in favor of the assumption that it was also intended to reach the Spanish warships which were supposed to be in the harbor. There will be other opportunities to treat of bombardments by American ships. I will therefore refrain from further remarks at this time, and only state it as my opinion that a reconnoissance of the place—and there can be no question of anything else, since the American fleet withdrew—could have been made with a much smaller expenditure of ammunition.

IV. Events At and Near Santiago de Cuba.

I will not attempt to give a connected account of all the happenings at and near Santiago and to set forth the reasons which inevitably led to the surrender of that place, but will confine myself to the relation of some circumstances which are not generally known, and which have come under my own observation.

1. There is a great deal of uncertainty as to the reasons why the garrisons of Guantanamo, Baracoa, etc., were included in the capitulation of Santiago. The following note of the Spanish chief of the general staff will serve to explain this matter. He says, among other things:

The garrison of Guantanamo, consisting of 7000 men, had been on half rations since June 15 and since July 1 they had received no rations at all, and had been living on green corn and horse meat. The garrisons of Baracoa, Sagua de Tanamo, as well as of the smaller places of Palma Soriano, San Luis, Dos Caminos, Morón, Cristo, and Songo would have been cut off and unable to retreat, and would therefore have been left to the mercy of the enemy, for the nearest place on which they could have fallen back was at least a seven days' march distant. That is the reason why these garrisons were included in the capitulation, and that of Guantanamo was included on account of the absolute lack of provisions. Hence about 10,000 men capitulated without having been at the front at all, simply owing to the peculiar circumstances.

2. In order to give a clear idea of the land fortifications of Santiago, which were considerably exaggerated in the first reports of the battles near the city, I annex a sketch of the same.

There was a line of ordinary trenches about 9 kilometers long from Dos Caminos del Cobre to Punta Blanca. I also noticed two batteries, but they were in such unfavorable positions that they could not take part in the battles of July 1 and 3. There were also wire fences and other obstructions in some places, as well as blockhouses, etc. The following data will show how few were the guns and of how inferior quality the material which the Spanish had at their disposal for the defense of the city. There were available—

Six 16-centimeter muzzle-loading guns, two of which became disabled after the first few shots, two more on July 12. It was known beforehand that these guns would not be able to fire more than a few rounds, owing to their defective mounts.

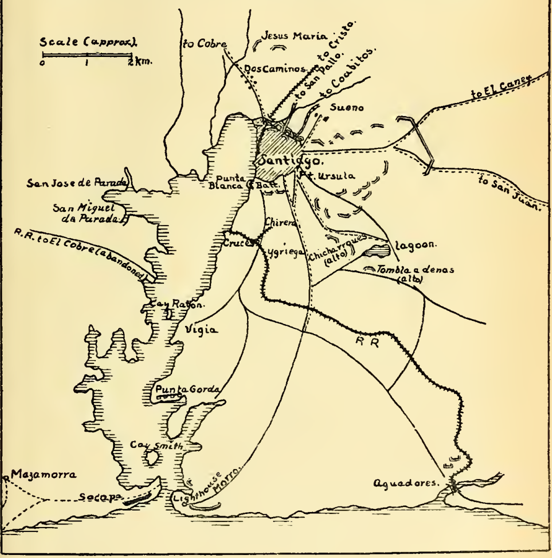
Five 12-centimeter muzzle-loading guns mounted on old carriages. On July 12 four of these were disabled, and the fifth was good for only two or three more rounds, although the charge had been reduced by one-half.

Twelve 8-centimeter muzzle-loaders, six of which were unserviceable.

Two 9-centimeter Krupp guns, one of which was dismounted and consequently disabled on July 2.

Two 7.5-centimeter Krupp guns.

Sketch of the Land Fortifications of Santiago



Besides these, the fleet had furnished two 9-centimeter Hontoria steel guns with a few rounds, which were not fired, and two 7.5-centimeter Maxim guns, which could not be mounted, because the breech mechanism had remained on board of the ships.

Therefore, aside from the muzzle-loaders, which were of very doubtful value, the Spanish had only two 7.5-centimeter and two 9-centimeter Krupp guns. Whether the former were given a chance to be fired at all is doubtful; probably the two 9-centimeter guns were the only ones that took part in the battles of July 1 and 3. It is evident that with such defective artillery for the defense on land there was no chance in a fight with the American siege artillery, which by July 10, according to statements of American officers, consisted of 34 guns that had been installed.

3. As to the strength of the Spanish troops in the line of attack, we have the following data:

On July 1 there were in the trenches 500 sailors from the fleet; 450 men of four companies of the Provincial Battalion of Puerto Rico, No. 1; 850 of the Talavera Battalion, No. 4; 440 of the San Fernando Battalion, No. 11; 350 of three mobilized companies: 350 volunteers. In all—Sailors, 500; regulars, 1740; irregulars, 350; volunteers, 350; total, 2940.

These were the fighting forces. Besides, there were in the city some cavalry of the Civil Guard and some soldiers who had been assigned to other duties. Of these troops, two companies, one of the Provincial Battalion of Puerto Rico and one of the Talavera Battalion, in all not over 250 men, were defending the fortified position of San Juan. At the Socapa there were 400 men, 450 at the Morro, and 120 at Punta Gorda battery. Finally, for the defense of the line from Las Cruces to Aguadores, about 4 kilometers, there were six companies of the Cuba regiment of infantry and two companies of irregulars, in all about 550 men.

4. The battles of July 1 and 3 at El Caney and San Juan are the only ones of importance in the campaign against Santiago. The above figures show that those two positions had very inadequate forces for their defense. It is incomprehensible why the Spanish commander in chief, after the American troops had arrived and their plan of attack was known, did not at least have the troops from Morro Castle and the Socapa, where they were

of no use whatever, co-operate in the defense of the threatened positions in the main line. To hold El Caney and San Juan as against the vastly superior American forces was an impossibility, although the positions were particularly well chosen and the ground very difficult for the assailants. With the same daring with which the American troops made the last assault on these positions, the Spanish defended them firmly and with coolness, firing one volley after another. On the spot they were to defend, officers and men fell in great numbers, with that courage which has ever distinguished the Spanish soldiers. When the Americans finally succeeded in the assault, they found the trenches of San Juan filled with dead, and they buried the brave Spanish soldiers where they had fallen by simply filling up the trenches with earth. The total losses of the Spanish during the defense of El Caney and the attack on the city were:

Killed—Brig.-Gen. Vara del Rey, 3 staff officers, 12 officers, and 68 men. Missing—Col. Jose Baquero, 4 officers, and 116 men. Prisoners—2 officers. Wounded—Lieutenant-General Linares, 6 staff officers, 30 officers, and 339 men.

On July 4 Colonel Escario succeeded in reaching Santiago with 3000 men. But these troops were exhausted from the march, and the city had no provisions for them. It was therefore no wonder that the power of resistance of the garrison was not strengthened by their arrival, and that the Spanish, in view of the bombardment which they could not answer, had no recourse left but to capitulate honorably.

5. An unlucky star was hovering over Santiago. No one had expected an attack on this city, and the events there are another proof that in war it is the unexpected and surprising operations, if well planned and somewhat favored by luck, that usually promise success. The Spanish troops were surely not wanting in bravery and good behavior. The cause of the defeat must therefore be sought elsewhere, and in my opinion it can be explained as follows:

(*a*) No thought had been taken of supplying the large cities with provisions. If not sooner, at least immediately after the breaking out of the war, the commander in chief ought to have assisted these places in the most energetic manner in laying in supplies, and where no blockade had been declared it could have been done.

(*b*) It was the plan of the Spanish commander to defend the whole coast, even the smaller harbors. This necessitated a scattering of the troops. If it was not deemed expedient to concentrate all the troops at Havana, the only truly fortified place, which maneuver would have completely changed the character of the war in Cuba, a concentration of the troops should have been effected at least within the eastern province as well as the western province. Why was it that Guantanamo was garrisoned by about 7000 men, Santiago de Cuba by 5000, and Manzanillo by 5000, and that at a time when Cervera's fleet had already entered Santiago Harbor? On May 28 at the latest, when the fleet had been closed in and there could no longer be any doubt as to the American plans, the troops should have been concentrated at Santiago, bringing with them all available provisions. The Americans might have taken Guantanamo and Manzanillo. That would have been of little importance from a technical point of view. The American troops would have met with energetic resistance upon landing and in their attack upon Santiago, and it is questionable whether they would have been able to break such resistance with 17,000 men.

(*c*) The Spanish troops had no field artillery, and their siege artillery was utterly unserviceable. It is due to this lack of artillery that the Americans were enabled to line up their forces without opposition from the Spanish; that they showed themselves superior to the Spanish, not in number only, in the fights against the fortified positions at El Caney and San Juan; and finally, that they were able to place their siege artillery in position without being harassed by the Spanish.

6. It now remains to speak of the manner in which the navy and army of both belligerent parties co-operated in joint operations, and finally, to examine minutely into the bombardments of the batteries of Morro Castle, the Socapa, and Punta Gorda. The destruction of Cervera's fleet will be treated in a separate chapter. Of course, in expeditions of this nature it is always the navy that furnishes the basis. If the control of the sea has been gained, but cannot be preserved, the transport and landing of troops are dangerous enterprises, which a wise commander will always avoid. Success is also dependent on a strong and well-equipped transport and war fleet. This should be borne in mind by all nations that are engaged in colonial politics and are in possession of colonies, in order to secure new markets for the surplus

production of men and merchandise. Of course the army, as the organ which is to execute the work, should be equal to the requirements made of it in a foreign country. But there is still another factor which plays an important part in such expeditions, and which should not be underestimated, and that is the co-operation of the navy and army. This factor has been lacking, not only on the American but also on the Spanish side. On the American side there was at least some agreement on important tactical questions and the navy placed itself willingly at the service of the army. But on the Spanish side the conditions were so peculiar that a co-operation of navy and army can hardly be spoken of, except in so far as marine troops took part in the battles at Santiago. Was Admiral Cervera under orders of General Linares or General Toral, or under Captain-General Blanco, or directly under the ministry of marine at Madrid? The first does not appear to have been the case, but it seems that Admiral Cervera received orders both from General Blanco and from the ministry of marine. Another example: The general de marina at San Juan de Puerto Rico was in command of the flotilla at that place; he was not under orders of Governor-General Macias, however, but under those of Admiral Mantarola, at Havana. I believe this question, which has hitherto been given little attention, had an essential share in sealing Admiral Cervera's fate. The co-operation of the navy and army is of the greatest importance, and at the great maneuvers in time of peace it should receive the same attention that other problems do.

7. The American fleet has in every respect performed its tasks in front of Santiago. The transport fleet was convoyed to the places chosen by warships, and the landings were effected under the same protection. A systematic blockade had been established, and in this connection the main object, namely, the destruction of Cervera's fleet, was never lost sight of. Thanks to the intelligent dispositions of the commander in chief of the fleet and the skill of the American officers and crews, this object was attained with complete success. Incidentally the batteries of the Morro, Socapa, and Punta Gorda were bombarded by the American fleet, and these bombardments offer so much that is of interest and so many points of discussion for naval officers that I shall have to speak of them somewhat more at length. How much has been said of these bombardments! How many times

have the batteries of the Morro and Socapa been placed out of action, the guns dismounted, the fortifications leveled to the ground! Batteries which did not even exist, as, for instance, Morro Castle proper and Estrella Battery, were said to have returned the galling fire, the latter completely destroyed, the former nothing but a heap of ruins! Such were the newspaper reports, of the inaccuracy of which I had an opportunity of convincing myself personally on the scene of events. Unfortunately, I am not in a position to state which of the American ships did the firing, nor how many projectiles were discharged in the different bombardments, nor the kind of projectiles and the results as to hits. But on the other hand I can give from personal observation accurate statements as to the condition of the Spanish batteries after the surrender of Santiago, and as my own observations have been supplemented by reliable information from others who were also on the scene, I am enabled to furnish sufficient material to permit an estimate of the actual conditions.

8. On the different days when the bombardments took place the following guns were available in the different batteries of the Morro, Socapa, and Punta Gorda:

ombardment.	Date.	Morro.	Socapa.	Punta Gorda.
1..............	May 18	One 16 cm. muzzle-loader mounted on a wooden carriage; could fire only three shots.	Two 8 cm. muzzle-loaders.	Two 16 cm. Hontoria howitzers, muzzle-loaders.
2..............	May 31	Same and four 16 cm. muzzle-loaders mounted on carriages.	One 16 cm. Hontoria naval gun not yet ready for service.	Do.
3..............	June 3	......do..................	One 16 cm. Hontoria......	Do.
4..............	June 6	......do..................	Same and one 16 cm. Hontoria naval gun.	Same and one 16 cm. Hontoria naval gun.
6..............	June 14	......do..................	......do..................	Do.
6..............	June 16	......do..................	......do..................	Same and one 16 cm. Hontoria naval gun.
7..............	June 18	......do..................	Same and two 21 cm. muzzle-loading howitzers.	Do.
8..............	July 2	Same and two 21 cm. muzzle-loading howitzers.	Same and one 21 cm. muzzle-loading howitzer.	Do.

Hence, on July 2 there were in all—

In the Morro battery: Five rifled 16-centimeter muzzle-loading bronze guns, only one of which was dismounted, and two 21-centimeter muzzle-loading howitzers which were fired on that day only.

At the Socapa battery: Two 16-centimeter Hontoria naval guns from the Reina Mercedes. Only one of these was dismounted. Further, three 21-centimeter muzzle-loading howitzers. East of this battery, on the extreme edge of the shore, there were for the defense of the first row of mines, one 5.7-centimeter Nordenfeldt rapid-firing gun, four 3.7-centimeter Hotchkiss revolving guns, and one 1.1-centimeter Nordenfeldt machine gun, all taken from the Reina Mercedes.

At Punta Gorda: Two 9-centimeter bronze Krupp guns, two 15-centimeter howitzers, and two 16-centimeter Hontoria naval guns from the Reina Mercedes.

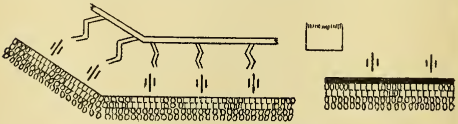
9. About three weeks after the surrender of Santiago, I visited these batteries and made the following observations:

Morro.

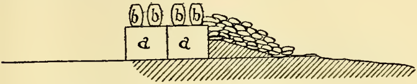
(*a*) Morro Castle proper, an old fort, consisting of heavy masonry standing close to the water's edge east of the harbor entrance, was not armed at all. It was used as barracks for the Spanish garrison. The outside walls had suffered considerably from the bombardments, the upper story had been completely destroyed, and in different places pieces had been shot away. The inner walls showed large and small shot-holes made by shells of different calibers, the largest of 30 centimeters.

(*b*) From the houses between the castle and the light-house, about 200 meters distant, nothing had been removed. Some of them had been completely destroyed, others more or less damaged. The houses situated a little farther back and lower down had suffered no injuries. The light-house, built of iron plates about 2.5 centimeters thick, had been pierced at the front by several small-caliber shells, the largest being of 15 centimeters. The rear wall had been blown out entirely.

(*c*) About 100 meters east of the light-house is the new battery, situated about 63 meters above the level of the sea. The following is a ground plan of this battery:



The guns are standing on concrete foundations built into the ground and fire over a wall erected for protection in front of them, consisting of wooden boxes filled with cement. This protection is further strengthened by sandbags placed in front of it. Between each two guns wooden barrels filled with cement have been placed on top of the wall. The spaces between them are partly filled with cement or sand. The cross-section between two foundations is about as follows:



a, Cement boxes; *b*, barrels filled with cement; *c*, sandbags.

The distance between each two guns is about 6 meters.

(*d*) Parallel with the front of the battery, at a distance of about 10 meters, a trench 1.5 meters deep and 60 centimeters wide has been dug. A smaller trench leads in zigzag line from each gun to this trench. For the two 21-centimeter howitzers, which were located farthest east and separated by a larger space from the 16-centimeter muzzle-loaders, there was a hole about 1.5 meters deep and 4 meters square, intended as a shelter. These shelters are said to have been frequently used by the Spanish.

(*e*) The five 16-centimeter muzzle-loaders are bronze guns dating from the seventeenth and eighteenth centuries. One of these bore the dates of 1668, 1718, 1769. About the middle of the present century these guns were adapted for centering by means of studs. The two 21-centimeter howitzers farthest east were rifled iron muzzle-loaders.

(*f*) All of these seven guns were mounted on iron sliding carriages with front pivots, turning on rails built into the concrete. As recoil checks, small iron plates were used which, at the rear of the top carriage, were pressed firmly against the compressor bars by means of an ordinary pivot screw. For indirect elevation of the guns there was an ordinary graduated disk with a hand. There was no sight scale on the graduated arc of the carriage. All the guns were adapted to be trained directly. When the Americans took possession of the battery they did not find any tangent scales, but the American chief of the battery stated that they had been there.

(*g*) Near some of the guns cartridges were lying about. A few feet west of the right-wing gun and a little to the rear was an uncovered pile of projectiles for the 16-centimeter guns. They were iron projectiles, with centering studs. The point, which was spherical in shape, contained a perforation for the fuse which had been stopped up with cotton waste. The fuses themselves could not be found. Near this pile of projectiles stood several cartridge boxes. Judging from the cartridge-bag material lying about and the powder scattered around, it may be assumed that the cartridges were being made right there.

(*h*) In the battery itself only minor injuries could be noted. The right-wing gun had been upset by a shell, but none of the other guns nor the cement protection had received any injuries. A few projectiles had struck into the ground in front of the sandbags and destroyed a few of them. Back of the battery was lying an American 20-centimeter shell, which had not been exploded. The base fuse had been removed.

Socapa.

(*i*) The new battery erected here is located, like that at the Morro, on the highest point of the ridge, about 400 meters west of the entrance.

(*k*) The five guns installed here are in a straight line—the three 21-centimeter howitzers in the left wing and the two 16-centimeter Hontoria naval guns in the right wing. The composition of the battery is about the same as that at the Morro, except that there are no barrels on top of the cement boxes at the 16-centimeter guns, probably so as not to restrict the angle of fire of these guns and because they are protected by a 3-centimeter shield. Immediately back of the guns is a trench of little depth connecting the gun positions with each other. The 16-centimeter guns are separated from the howitzers by a broad traverse.

(*l*) The 21-centimeter howitzers are like those at the Morro. The two 16-centimeter Hontoria guns were taken from the Reina Mercedes. They are long guns of modern construction on central pivot mounts, but not rapid-fire guns. The pivot sockets are built into the concrete foundation. These guns could probably not be fired oftener than once in two minutes.

(*m*) About 20 meters back of the guns was a frame house with sheet-iron roof, built partly into the ground, and protected toward the sea by a small embankment of earth. This was an ammunition magazine for the battery. It still contained a number of 16-centimeter projectiles with the necessary cartridges and powder boxes. The place was little suited for an ammunition magazine, and it is a wonder that it was not hit.

(*n*) Evidently the Americans fired more sharply at this battery than at the Morro battery, probably because it contained the only modern guns whose effects were to be feared.

One of the howitzers had received a hit of small caliber in the left side of the top carriage, but without placing the gun out of action. The shield of one of the 16-centimeter guns had been pierced from below by a 15-centimeter projectile, and the carriage had also been injured, so that the gun became unserviceable. No other damages are noticeable in the guns, but at different places shots had passed immediately in front of the guns and hit the gun protections and sandbags.

Punta Gorda Battery.

(*o*) This battery was not fired upon by the Americans, although it took part in the firing on several occasions.

10. According to the above, the final result of the numerous bombardments was but one gun placed out of action in the Morro and one in the Socapa battery. The loss in human life was a few killed and wounded. Punta Gorda battery, the only important position in a question of forcing the harbor entrance, remained uninjured. As I have already said, I am unable to state the total number of projectiles which the American ships fired in order to attain this modest result. In any event, the number is out of proportion to the result, and has proved once more a fact well established by the history of naval wars, namely, that coast fortifications are extremely difficult to place out of action, even with an expenditure of large quantities of ammunition. The American method of firing may perhaps be susceptible of improvement—that is not for me to say. But the American naval officers may take comfort in the thought that other seafaring nations would not have done any better in their place—perhaps not so well; for no navy, with the exception of the French, has made it a point in time of peace to make the bombardment of coast fortifications, fortified cities, etc., the subject of thorough, practical study.

11. As for the fire of the Spanish batteries, I have read of but one case where a Spanish projectile hit an American ship. It

was in a fight with the Socapa battery that the battle-ship Texas received a hit, probably from one of the 16-centimeter guns taken from the Reina Mercedes. The projectile struck the port side about 20 feet abaft the bow and exploded, after passing through a stanchion between decks killing one man and wounding six. The American officer who took charge of the battery at Morro Castle also told me the following amusing incident: There was a bombardment of the Morro battery at night, and one of the American ships was throwing her search-light on the battery. The Spanish answered the fire part of the time. The ship with the search-light was not hit, but the battle-ship Iowa, lying quite a distance away in the dark, was unexpectedly struck by an accidental hit from one of the Spanish howitzers. The projectile passed through the deck, entered the officers' mess-room, exploded there, and caused some minor damages to the rooms; but none of the crew were hit. But what more could be expected of the kind of guns the Spanish had at their disposal? It must surely have given the American officers who took charge of the battery a slight shock when they saw the dates 1668, 1718, etc., on the guns which they had been fighting. Part of the mediæval howitzers still had charges in them when the American officer took possession of the Morro battery. He therefore decided to fire them, which gave him an opportunity of establishing the fact that even with the greatest elevation the range was only 800 yards! It is possible that the cartridges had suffered from humidity; but, on the other hand, it is quite as probable that this was really their greatest range. One thousand meters was not a bad performance for guns of the seventeenth and eighteenth centuries. No wonder that the Spanish could not reach the hostile ships with these guns! This will also explain why the Spanish garrisons, seeing the uselessness of their efforts, often stopped firing during the bombardments and withdrew to the trenches. It was on these occasions that the newspaper reports stated that the batteries had been silenced, when, as a matter of fact, they were uninjured and in condition to resume their "unbloody work" at any time.

12. But now another question. Did the American fleet really allow itself to be deceived by these batteries? In the beginning, perhaps. And why not? I do not hesitate to acknowledge that I had the same experience, together with several other officers. When we inquired into the nature of the batteries, we had no

idea of the venerable age of those guns, but set them down as 12 and 16-centimeter guns. It is true that we did not go through a fight with the batteries, and that is the essential factor for estimating their efficiency. From observations made at the Spanish batteries I judge, as already stated, that the Socapa battery was the main objective of the Americans. They seem to have known that the only serviceable guns, namely, the 16-centimeter Hontoria guns from the Reina Mercedes, had been set up there; but Morro battery, too, was fired upon quite a number of times. Would the Americans have done this if they had known what miserable guns their enemies had? Hardly. So there can be no doubt that in the beginning, at least, the Americans were deceived as to the strength of the foe, whom they overestimated, as is usually the case in war. Moreover, there was no occasion for the American commander of the fleet, even if the Spanish batteries had been recognized as efficient and dangerous, to attack them under prevailing circumstances. If the harbor entrance was to be forced, neither the Morro nor the Socapa battery need have been considered, because they could not sweep the narrow entrance with their guns. The Punta Gorda battery was the only one that controlled the entrance, and owing to the great distance and the difficulty of observing the fire, it was almost impossible to place this battery out of action from the sea. Then, why the bombardments of the batteries and the immense expenditure of ammunition, especially since the American commander in chief did not intend to force the entrance, but on the contrary was desirous of obstructing it, as is plainly shown by Hobson's attempt? A simple blockade, without any further attack on the fortifications, would have had exactly the same result. I cannot possibly believe that the American commander in chief had nothing more in view than to harass the enemy by the numerous bombardments and reassure the home press. My idea is that Admiral Sampson, as a practical and experienced gunner, had a very definite object in view in these bombardments. I have no proofs to offer in support of this assumption, but I have an idea that there is something in it. After the batteries had been brought out all the subsequent bombardments were nothing more or less than target practice. The Admiral wanted to accustom his officers and men to sharp firing. The whole crews were made to practice at regular intervals—the commanders in the manner of handling their ships, the officers in conducting and superintending the firing, the gun captains in training and aiming, the gun and ammunition crews in serving the guns and passing the ammunition, and all these under conditions of actual war, in fights with coast batteries. When the decisive day arrived—the battle on the high sea, ship against ship—the American fleet was well prepared and able to achieve its task in a brilliant manner and in the shortest possible time.

13. Whether I am right or wrong in this assumption, whether it was a question of actual bombardments or of target practice, the final result remains the same. Even at target practice each one fires as well as he can. Therefore we are still confronted with the fact that the coast fortifications, in spite of vastly superior naval artillery and the expenditure of immense quantities of ammunition, were not placed out of action. What lessons are we to derive from this?

Aside from the forcing of harbor entrances, where the assailant must eventually expose himself for a short time to the hostile fire, cases may arise in war where it becomes necessary prior to such forcing, or for other reasons, to destroy certain forts. The history of war teaches us that this is one of the most difficult problems. It should therefore be made a subject of study in time of peace, the same as any other problem. Of the necessity of studying tactics and strategy and their practical application, every one is convinced, from the commander in chief to the youngest lieutenant. Immense sums are being expended for coal alone in order to have the ships of the fleet pass through all manner of evolutions in tactics and strategic maneuvers. Money should also be devoted to target practice under exactly the same conditions as in actual war. For what is it that decides a naval battle? The tactics of the commander in chief of the fleet and the commanders of the different ships are certainly of some influence on the battle, but nothing more. The decision will always be dependent on the good training of officers and men for the fight and the good firing of gun captains and officers. That it what the naval battle of Santiago has once more plainly demonstrated.

V. The Blockade of Havana and Cienfuegos.

1. Immediately after the rejection of the Union's ultimatum by Spain, and the breaking off of diplomatic relations between the two nations, Havana was blockaded, and later Cienfuegos.

On our way to Havana, about the middle of May, we met in the Yucatan Channel the first American warships. They were a cruiser of the Raleigh class and a torpedo cruiser. The former, painted dark gray and stripped for service, having only a signal yard at the fore-top-mast, being in all other respects cleared for action, made a good appearance. A large number of the crew were standing on the upper deck and near the guns, curiously eying the foreigner who had entered the line of blockade. After the exchange of a few signals as to name, place of departure, and destination, we resumed our course for Havana. The next morning (May 17), through the veil of mist covering the shore, we had a first glimpse of the mountain at Mariel, which, by its peculiar shape, affords the sailor an excellent point of bearing. A heavy fog was still enveloping Havana, and was not dispersed until the sun rose higher in the cloudless blue sky. The first object that met our eyes was the old castle of the Morro, with the red and yellow Spanish flag waving proudly in the wind. We could distinguish the high light-house to the left of the entrance, and adjoining it a huge mass of stone walls and fortifications. Havana from the sea forms a singularly beautiful picture; but this was a time of war, and our eyes, after gazing admiringly on the magnificent panorama, turned, as though instinctively guided by the military spirit, to the long rows of fortifications visible close to the shore at the Vedado, indistinctly at first, then more and more sharply. There was much to be seen. During the short moments while we were passing by, we had to observe carefully in order to gain at least an approximate idea of the value and strength of the forts. The whole line of fortifications at the Vedado appeared to have been recently constructed. At Santa Clara and La Reina workmen could be seen strengthening and changing the original batteries. To the left of the harbor entrance, also, we could see two or three newly erected batteries extending as far as Cochima (Cojimar?).

The American blockading vessels remained at a considerable distance and were apparently composed of only a few gunboats of the Annapolis class and auxiliary cruisers (small steamers or yachts armed with a few rapid-fire guns). We were slowly approaching the harbor entrance, and with the assistance of a pilot entered the harbor, passing through the mine obstruction and the channel, which was literally lined with guns, though mostly of old designs. Great numbers of people, mostly soldiers and workmen, were crowding both sides of the entrance. Silently they were staring at our ship, and the same dismal silence also prevailed in the harbor itself. The beautiful wharves for loading and unloading steamers were empty. Only a number of workmen out of employment were sitting or lying around. A few boats were moving about in the harbor. All the others, as well as the larger sailing vessels which in time of peace are engaged in coasting trade, were at anchor in the inner harbor. The coal depots at the other side of the harbor contained immense supplies, but at the quays and coaling piers, which are the busiest places in normal times, there was not a single vessel to be seen. Finally, when we entered the harbor proper, we saw a few Spanish warships—the cruiser Alfonso XII, torpedo gunboats Marques de la Ensenada, Nueva España, Conde de Venadito, and a number of smaller gunboats. These ships, also painted grey, stripped for service and cleared for action, made at a first glance a very good appearance, especially the large cruiser; but a second glance through glasses sufficed to convince us that the large cruiser, Alfonso XII, had no large guns on board, which caused us to infer that on the inside also everything was not as it should be (and, indeed, it appeared subsequently that the boilers were unserviceable). Close to the Alfonso XII the wreck of the Maine could be seen above the water, furnishing the key, so to speak, to the strange changes which Havana had undergone in such a short time, the warlike preparations of the garrison on the forts outside, the stillness of the harbor, the inactivity of the population, and the appearance of the Spanish warships cleared for action.

2. A walk through the streets of the city revealed the usual every-day life. Of course the traffic was not as great as in time of peace. The wealthier families—Cubans and Spaniards as well as foreigners—had left Havana in large numbers. Many beautiful houses, the former residences of these families, were now standing empty. Beggars were lying about in front of the church doors and in the main streets, among them women with half-starved little children, but not in very large numbers. Many a coin was dropped into their out-stretched hands by the passers-by; but there was nothing to indicate at that time that the blockade had entailed serious results for the poorer population. Many

stores in the principal streets were open, but in the majority of cases the clerks were taking it easy, either in the store or in front of it. The restaurants and cafes, on the contrary, were enjoying good patronage. The prices, of course, were higher than usual, but not extravagant; and for good pay, good dinners could be had in these restaurants. Meat was, on an average, 1.50 marks (37 cents) a pound. Eggs were particularly expensive. The general opinion was that there were sufficient provisions in the city to sustain the blockade for some length of time; but what was to become of the poorer class of the population in that event was a problem. At the restaurants the large number of uniforms was striking. They were worn by the volunteers, who were represented at the capital in particularly large numbers. A special guard of honor of volunteers had been ordered for Captain-General Blanco, and they had taken charge of the guard service at the palace. As for the military qualities of these half soldiers, they were probably not of a high character, for proper training and drilling were lacking here as well as in Puerto Rico. From the city I went to the seashore and took a look at the fortifications, especially Santa Clara and La Reina, and I could not help admiring the energy and zeal of the Spanish. Everywhere the greatest activity prevailed. From early until late work was going on at the fortifications. The old forts were being strengthened by earthworks and heavy guns mounted at Santa Clara. In some of the forts volunteers could be seen practicing at the guns until late at night; other divisions of volunteers had gathered for instruction; feverish activity everywhere, from the private to the officer and Captain-General. The latter frequently visited the forts and inspected personally the progress of the work. But in view of all this energy one may well ask, Was there not too much to be made up that had been neglected in time of peace? It is not possible to make soldiers, especially accurate and cool-headed marksmen, in a few weeks or months. That can only be done by constant practical training under able officers in time of peace.

3. On May 14 the Spanish gunboats Conde de Venadito and Nueva España had made an attack on the American blockading vessels, and as this is the only instance of initiative on the part of the Spanish ships at Havana, I will give an account of it. The Conde de Venadito is one of the older cruisers, of 1200 tons

displacement, launched in 1888, having a speed of 12 knots, armed with four 12-centimeter guns and a few light rapid-fire guns. The Nueva España is a torpedo gunboat of 600 tons, armed with two 12-centimeter guns and a few light rapid-fire guns, reputed to have a speed of 18 knots, but in reality she would probably not make more than 14 knots. The 12-centimeter Hontoria guns were installed behind shields. According to the statement of a Spanish officer, these could be fired not oftener than once in five minutes. No target practice had taken place. The Nueva España had fired the first shot at an American warship. Her torpedo armament consists of four Schwartzkopff torpedoes of the older type, with small explosive charge (about 25 kilograms), and two torpedo-tubes. No regular exercises in torpedo launching had taken place. Both vessels have a great deal of woodwork. On the forward conning bridge is a saloon with heavy wood wainscoting, tables, chairs, etc., none of which had been removed for the fight. Both ships went out to sea at 5 o'clock P. M., followed at some distance by two small tugs. The blockading line was quite a distance from the shore, and it was about an hour before the engagement commenced. Five American vessels, probably only gunboats and auxiliary cruisers, were soon surrounding the Spanish ships, so that the latter could use their guns on both sides. The vessels approached to within 8 kilometers. A successful hit from the Spanish is said to have caused the American ships to retreat, but owing to the darkness the Spanish ships did not dare follow them, and returned to Havana at 8.30 P. M. without having been hit once. This was not very much of a success, and does not appear to have raised the spirit of the Spanish; for, even after the harbor flotilla had been reinforced by the cruiser Infanta Isabel, it never again attempted an attack on the American ships, either at night or in daytime. That does not speak very highly for the initiative and spirit of enterprise on the part of the Spanish naval officers, especially as the blockading fleet consisted only of gunboats and inferior auxiliary cruisers, which later were reinforced by the large cruiser San Francisco. Even the latter might have been successfully attacked at night by the Spanish torpedo-boats under able command and with intelligent handling of the torpedo weapon.

4. In order to cut off the supply of provisions from the sea the cities of Matanzas, Cardenas, and Cienfuegos, which are con-

nected with the capital by railway, had been blockaded since the beginning of the war. Several attempts of the United States to land troops at these places were unsuccessful, owing to the inadequate means with which they were undertaken. The Americans therefore confined themselves to a few insignificant bombardments, and finally to the blockade alone. When I arrived at Cienfuegos, on June 11, I did not meet a single American vessel keeping up the blockade, either in Yucatan Channel or in front of Cienfuegos. I have subsequently been told that the American ships would often leave the harbor without any guard and then suddenly reappear at the end of a few days. I infer from this that the Americans did not handle the blockade service very strictly at Cienfuegos. The result was that several steamers were successful in running the blockade. If the Spanish Government had used some energy in securing blockade runners at the beginning of the war, or had encouraged them by premiums, Havana, as well as the other provinces of the island, could have been abundantly supplied with provisions. How little such enterprises were supported by the Spanish Government is shown by the fact that at Cienfuegos, for instance, two large steamers were lying idle during the whole period of the war, while with a little more energy they might have been of the greatest service. Besides Cienfuegos, the waters near the Isle of Pines—the town of Batabano among others—were very favorably situated for blockade runners. From suitable anchoring places in deep water, which are abundant in that vicinity, the cargoes could have been taken ashore by smaller vessels. Of course, all such matters require preparation and decisive action—conditions which did not exist among the Spanish. As a matter of fact, at different times in the course of the war supplies did reach Cuba just in that manner, and that was the reason why the United States saw themselves compelled to extend the blockade from Cape Antonio to Cape Cruz, the whole territory here under discussion.

5. When we arrived at the entrance to Cienfuegos we noticed to the right the ruins of a light-house, which the Americans had fired upon in an unsuccessful attempt at landing. To the left of the harbor entrance, which was now plainly visible, was a large castle in the usual Spanish style of architecture, standing on an elevation, and below it the town, which, with its white houses hidden among trees, reached down to the water's edge. The

houses were mostly one-story high, with porches running all around. Some boats and small steamers were lying at the landing piers. After hoisting the necessary signals and waiting patiently we saw two Spanish gunboats approaching. We could plainly see that they had been cleared for action and were extremely suspicious, for they advanced but very slowly. Finally, they seemed to come to the conclusion that the white ship with awnings, lying there quietly, without any warlike preparations, could have only a peaceful mission. A boat was lowered, the pilot came on board, and we ran in. The entrance is similar to that at Santiago de Cuba, and quite narrow. There is a bend to the north which makes it difficult for large ships to enter the harbor, because the current coming from several directions is usually very strong at this place, so that a ship turning slowly might easily run aground on the eastern point. Here also the indefatigable activity of the Spanish troops could be noticed. They were working energetically on new batteries, which were armed with field guns. There were mines in the entrance. Works of defense, trenches, etc., had been built in the direction of the castle. The number of regular troops was conspicuous; there appear to have been no volunteers at that place. As we passed, the soldiers stopped in their work to take a look at the ship. At one of the landing piers, at the narrowest place of the entrance, a crowd of people and regular soldiers had gathered. A band on the porch of one of the houses was playing "The Watch on the Rhine," a courtesy extended to the German ship by the Spanish commander. We steamed into the large bay and after passing several small islands and shallow places we saw before us the city of Cienfuegos. The channel is narrow even here; the large bay has many shallow places, and only a narrow passage leads to the city, at which our ship cast anchor some distance from the shore. Nevertheless, the harbor of Cienfuegos is one of the best of the whole island of Cuba, and with the expenditure of the necessary funds a very fine place could be made of it. Outside of Santiago, whose commerce, owing to the inaccessibility of the country back of it, will probably never be developed to any great extent, Cienfuegos is the only harbor on the southern coast, and has therefore probably a great future. It is also to be noted that the largest sugar factories of Cuba, which are mostly operated by American capital, are in the vicinity of Cienfuegos.

6. The small Spanish gunboats lying in the harbor were doing guard service at the entrance, relieving each other every day. Besides these the torpedo-boat cruiser Galicia was in the harbor. An unlucky star seems to have been over this vessel. At first it was stated that she was to be docked in order to make repairs. Afterwards she was again pronounced seaworthy; but the fact is that she never left the harbor during the whole period of the war. There was no lack of provisions noticeable in the city. The Spanish Government had bought up the provisions and set selling prices on them. For instance, a pound of beef was only 80 pfennigs (16 cents)—certainly a low price considering that the blockade had already lasted two months. On June 13 gun fire was heard in the direction of the entrance. The Spanish gunboats went out and had a slight engagement with an American auxiliary cruiser, probably the Yankee. The gunboat Vasco Nuñez de Balboa was shot through the bow above the water-line, and several of the crew were wounded. In other respects the engagement was of no importance. The following day we left Cienfuegos, spoke the American cruiser Yankee, which was on blockade service, and after stopping a few days at the Isle of Pines we shaped our course for Havana.

7. In the morning of June 22 we came within sight of the tableland. We kept close to the shore in order to inspect the harbor of Mariel and to see how far the American blockading line extended. It was not long before the blockading ships, among them the gunboat Wilmington, which was lying close to Mariel, came in sight. There was the usual exchange of signals. A heavy thunderstorm was threatening. Morro Castle, which had been visible in indistinct outlines, disappeared behind a dark cloud. The storm came up rapidly. The flashes of lightning followed each other in quick succession, the thunder roared, and the rain was coming down in torrents with a force only possible in the tropics. The blockading ships had vanished from sight. We could hardly see a ship's length in front of us, and the torrents of rain continued to fall, merging the lines of the sky and the sea. As we had made out Morro Castle before the storm commenced, I had the ship steer for it very slowly. Soon it commenced to clear up in the direction of the land, and while the storm continued to rage on the sea and the whole line of blockade was still enveloped in rain, we entered the harbor with the

assistance of the pilot. Involuntarily the thought occurred to me, what an opportunity that would have been for a blockade runner; but the matter is not as simple as it looks. It is true that at this season of the year a heavy thunderstorm, usually about noon or in the afternoon, may be counted upon almost daily. Still the chances of being thus favored are too slim to make it advisable for a ship to attempt to run the blockade in daytime. The only real opportunity is at night. The American blockading fleet consisted of the gunboat Wilmington, two gunboats of the Annapolis class, one or two monitors and about four auxiliary cruisers, the latter partly small vessels. The ships were distributed over a line about 30 miles long, surrounding the harbor in an arc at a distance of about 120 to 140 kilometers. In my opinion it would not have been difficult for a fast ship (15 or 16 knots would have been sufficient, since the American blockading vessels, with the exception of a few small cruisers, did not exceed 12 knots) to run the blockade at night. The requirements were that the night should be as dark as possible, the lights on board darkened, and the course shaped straight for the entrance through the middle of the blockading line. As the beacon light was kept burning all the time, there was no difficulty about steering for the entrance. The blockade runner would have had to depend entirely on her speed and maintain her course without regard to hostile projectiles. The firing of guns, including rapid-fire guns, with night sights is so difficult that hits can hardly be counted on unless the distance is very small. To approach the line of blockade by hugging the shore I consider hazardous. The vessel could not have remained entirely hidden, owing to the close formation of the line. There would have been danger, as soon as the alarm signal was given, for the blockade runner to be cut off from Havana by the blockading fleet and forced upon the shore.

8. Since our last visit to Havana, about a month ago, there was hardly any change noticeable in the aspect of the town and the conditions prevailing there. The harbor was empty and deserted. Two steamers, however, could be seen, of rather enterprising appearance, one of them even with two small rapid-fire guns on board. The Spanish warships were still at anchor at the same place. There were no foreign warships. Work on the improvement of the fortifications was still going on with the

same restless activity. The volunteers continued their drills. Provisions were expensive, but the prices were held down by the Government, so as to prevent excesses on the part of the dealers. The poor were being taken care of as far as possible by the distribution of food in free kitchens and by entertainments for their benefit. The theaters were kept open. On certain days there was music in the public places. The Governor-General did all he could to keep up the spirit of the inhabitants. The rate of sickness and death was said to be hardly higher than usual. The climate at this time of the year is especially unfavorable, because the beneficial effects of the rainy season are not yet felt. Inside of the fortified region the Government had laid down so-called zonas de cultivo, which were intended for the raising of vegetables, etc., and were expected to prove of great benefit. One of the chief articles of food consisted of pineapples, which in time of peace are exported in incredible numbers, and which could now be bought in quantities for a fabulously low price.

9. In the forenoon of June 24, I noticed some preparations on board the Spanish steamers Montevideo and San Domingo, from which I inferred that they were about to put to sea. The time was well chosen. The moon set about 10 o'clock, and at midnight both steamers, with all lights darkened, passed through the entrance. They were successful in eluding the American ships. I afterwards met the Montevideo again at Vera Cruz, with a full cargo, ready to leave the harbor at any moment; but as far as I could ascertain, the steamer, after putting to sea, preferred to return and unload her cargo again. The San Domingo, upon her return to Cuba, was captured by American blockading ships and run ashore near the Isle of Pines.

10. We remained at Havana until June 29. We then proceeded to Kingston and from there to Santiago de Cuba and Cienfuegos, casting anchor at the latter place on the evening of July 8. The blockade was now quite strict, as we had an opportunity to find out upon approaching Santa Cruz. At Trinidad we met the American gunboat Helena, and at Cienfuegos the cruiser Detroit, lying close to the harbor. Nevertheless, the auxiliary cruiser Reina Maria Cristina, a large, fast steamer, armed with fourteen 5-centimeter rapid-fire and several revolving guns, had succeeded in entering the harbor of Cienfuegos.

Her cargo consisted of dried codfish and ham. Part of the steamer's guns and ammunition were used to reinforce the fortifications. The city itself had not again been harassed by the American ships. Communication with Havana by rail was kept up, though there were frequent delays in the arrival of trains, owing to the lack of fuel. There did not appear to be any great scarcity of provisions. A proclamation by Captain-General Blanco, published in the Gaceta de la Habana, apprised the city of the catastrophe of Santiago, which was so disastrous to the Spanish.

The Spanish at Cienfuegos gained an idea that the ships had gone down with all their crews. It was not learned at that time that the ships had been run ashore and that the Americans had taken many prisoners. The heavy blow was borne with comparative equanimity. It was the general opinion that the fate of Santiago was also sealed and that then peace negotiations would be opened.

11. On July 10 the crew of the steamer Alfonso XII arrived at Cienfuegos and was transferred to the auxiliary cruiser Reina Maria Cristina. The Alfonso XII had attempted to run the blockade at Havana, keeping close to the shore, but had been compelled by the American blockading ships to run ashore at Mariel. The majority of the crew was rescued. The cargo was destroyed by the Americans, who fired upon the steamer and set her on fire. In connection with this attempt to run the blockade we seek in vain for an explanation as to why the cruisers, torpedo gunboats, and other vessels in Havana Harbor did not assist the blockade runner. The time of her arrival could have been announced by cable. It then became the duty of the Spanish warships to go out in accordance with a prearranged plan and try to divert the blockading ships. Such a maneuver would not only have raised the moral courage of the garrison, condemned to demoralizing inactivity, but would in all probability also have been attended with success.

12. We left Cienfuegos on July 12, and after visiting Vera Cruz, again returned to Havana on August 1. The blockading fleet appeared to have drawn closer together, so that there was one ship to every two miles. The flagship San Francisco was also seen this time. Few changes were noticeable in the city itself. There was not as yet an actual famine, but the poorer

classes were evidently much worse off than they had been on our former visit, for the number of beggars in the streets had increased. Crowds of poor people would come alongside the ships in boats to try to get something to eat. It was a sad sight to look upon those half-starved women and emaciated little children, barely covered with miserable rags, holding out their hands imploringly and asking for alms. Everything floating around in the water was examined by these miserable people. Nothing escaped their eyes. Parings of fruit and other refuse were caught up and sucked out. The suffering was terrible, and we were powerless before it. All could not be helped, but at least a few. This scene was repeated every noon and evening. The crews gave willingly what could be spared, and more than that. Ashore, as already stated, the poor people were being taken care of as far as possible by free kitchens. Since the middle of July about 30,000 rations had been distributed in these kitchens. The health conditions were remarkably good this year. Yellow fever had not yet made its appearance, but there was typhoid fever and dysentery. The sentiment of the population, as well as of the troops, seemed to incline toward peace. A general feeling of listlessness had settled upon them since the capitulation of Santiago. "If the Americans would only attack Havana," the people would say, "they would soon find out what the garrison of the capital is made of. They would get their heads broken quick enough. But Uncle Sam is only beating about the bush. He is not going to swallow the hot morsel and burn his tongue and stomach." No wonder that the Spanish troops, condemned to inactivity, poorly fed, cut off from the whole world, and without any prospect of relief, were anxious for the end to come. And so peace was being talked of everywhere, and there was a persistent rumor that the French ambassador at Washington had been empowered to conduct peace negotiations.

13. After a cruise around Cuba, Haiti, and Puerto Rico, upon which I had started at the beginning of August, I returned to Havana for the fourth time on September 3. How different everything looked! The clouds of smoke of the blockading ships were no longer seen on the horizon. That circle of brave vessels, greedy for prey, ready every moment to pounce upon anything that came within their reach, had vanished. Our first glance was for the flag on Morro Castle. The red and yellow

colors were still waving there, but there seemed to be an air of sadness and listlessness about them, as though they were anticipating their fate of having to make way for another flag without having been conquered. The harbor entrance was animated. Many sailing vessels were going in and out. In the harbor itself German, English, and Norwegian steamers were busily engaged in loading and unloading. Alongside the custom-houses there were a number of American and Mexican sailing vessels that had brought food and wine. All the storerooms were filled with provisions of every kind. The city had awakened to new life, business houses were once more open, merchants were again at their work, the streets were full of people; yet there was an air of depression over the whole city. The one thought, what was to become of them now, seemed to have cast a spell over everything. The insurgents were lying close to the city, and many of the inhabitants of Havana went out to visit with friends or to satisfy their curiosity. Will the United States succeed in dispelling the specters they have conjured up? Will Cuba Libre triumph, or will the island be annexed to the Union? These are the questions which are now ever present.

14. As peace is now at hand, there is no reason why a discussion of the fortifications of Havana, which were erected or improved by the Spanish with so much skill, should be kept secret any longer. I will therefore try to give an approximate idea of the same:

(*a*) The harbor entrance had been made inaccessible by several rows of mines. Along the entrance many guns had been set up which were fired through embrasures from behind thick masonry walls. All these guns were muzzle-loaders of old types. Farther inland there was a torpedo battery—two ordinary launching tubes, which had been temporarily installed on a float without any protection.

(*b*) The object of the shore fortifications was partly to defend the entrance and partly to prevent landings. During the first few days after the breaking out of the war the Spanish had feared a bombardment of Havana and a landing of American troops at the Vedado, and this fear was well founded, as there was only one fortification on the Vedado, and that not entirely completed. The Americans allowed that opportunity for attacking Havana by surprise to go by without taking advantage of it, because they were themselves by no means prepared for the war and had neither troops nor transports in readiness. By dint of unremitting activity the Spanish were able in the course of the war to place the following works in good condition, part of them having been newly erected:

East of the Entrance.

Battery No. 1 (permanent): Four 15-centimeter Ordoñez guns; on the wings, two 5.7-centimeter Nordenfeldt rapid-fire guns.

Battery No. 2 (permanent): Two 30.5-centimeter Krupp guns; four 21-centimeter Ordoñez howitzers; two 5.7-centimeter Nordenfeldt rapid-fire guns.

Velasco battery (temporary): Three 28-centimeter Krupp guns; three 12-centimeter Hontoria naval guns; one 5.7-centimeter Nordenfeldt rapid-fire gun.

Between the latter two batteries there were three small temporary batteries, the first of which was armed with two 9-centimeter field guns and the second and third with three 12-centimeter and 15-centimeter guns, respectively.

West of the Entrance.

La Punta (permanent): Two 15-centimeter Ordoñez guns.

La Reina (permanent, but considerably strengthened and newly armed): Three 16-centimeter Hontoria naval guns (from the cruiser Alfonso XII); two 25-centimeter muzzle-loaders; seven 21-centimeter muzzle-loading howitzers.

Santa Clara (permanent, but considerably strengthened and newly armed): Two 30.5-centimeter Ordoñez guns; three 28-centimeter Krupp guns; four 21-centimeter howitzers. On the flank, two 5.7-centimeter Nordenfeldt rapid-fire guns and three 15-centimeter guns.

Battery No. 3 (permanent): Four 21-centimeter Ordoñez howitzers; two 15-centimeter Ordoñez guns; two 24-centimeter Ordoñez guns.

Battery No. 4 (temporary): Three 16-centimeter Hontoria naval guns (from cruiser Alfonso XII); four 15-centimeter Ordoñez guns; two 5.7-centimeter Nordenfeldt rapid-fire guns.

Besides these, temporary stands had been erected on the west wing for field guns.

(*c*) The shore fortifications had their bases of support in some of the larger forts, like El Principe and Atares forts, forming the inner belt around the city. An outer belt had also been established at a distance of about 10 kilometers from the city. The fortifications on the outer belt consisted of a large number of infantry sites protected by artificial obstructions, stakes, wire fences, etc. For each two or three of these sites there were more extensive works with gun stands. Thus, all the important points had been connected by one long line of fortifications. The defense of the coast east of battery No. 1 near Cochima (Cojimar?) was surprisingly weak. Batteries Nos. 1 and 2 are trained toward the sea; only one 4.7-centimeter rapid-fire gun covers the flank. The fortifications on this part of the coast consist of only one gun site with two field guns. It would seem as though a landing with a sufficient force of troops, assisted by the fleet, might have had a chance of success. Fortunately for the city the fortifications were not put to a severe test. Aside from a few shots at the beginning of the blockade, about twenty shots were fired at the American cruiser San Francisco toward the end of the war, namely, on August 12. The ship did not answer the fire. A Spanish projectile hit the stern of the American cruiser as she was steaming away, but without causing serious damage or loss of human life.

15. In order to show in a comprehensive form the steamers which during the war ran the blockade of Cuba, I give in the following table the names of the steamers and the different harbors they entered, together with their respective cargoes:

Harbor.	Name of ship.	Date.	Cargo.
enfuegos	Steamer Montserrat	Apr. 26	War material.
Do	Steamer Adula	June 17	50 barrels flour, 50 barrels corn, 50 sacks rice, 10 tubs butter, 15 barrels pork, 15 barrels beef, 10 barrels hard tack, 6 sacks beans, 5 sacks peas.
Do	Steamer Reina Maria Cristina.	June 22	1000 boxes bacon, 50 barrels bacon sides, 600 barrels codfish, 200 sacks beans
ıntiago de Cuba *a*.	Steamer Polaria	May 7	300 sacks barley, 14,000 sacks rice.
ılbarien *a*	Steamer Alava	July 4	2500 sacks flour, 6 barrels codfish.
Do	Steamer Franklin	....do...	2495 sacks flour, 3056 sacks corn, 200 sacks spices, 333 sacks potatoes.
anzanillo	Steamer Anita	*b* June 18	Small quantities flour, rice and meat.
ıgua la Grande *a*.	Steamer Fritjof Nansen	July 3	Small quantities potatoes, onions, meat and rice.
atanzas	Steamer Montserrat	July 29	8000 sacks rice, 806 sacks beans, 600 sacks peas, 500 sacks flour, 1399 boxes bacon, 213 boxes codfish, a large quantity of smoked meat, 15 barrels drugs.
ıyo Frances *a*	Steamer Franklin	July 31	3495 sacks flour, 1350 sacks corn, 500 sacks rice, 165 sacks beans.
atabano	Coast steamer Arturo	*b* June 13	800 sacks corn, 150 sacks flour, 20 sacks peas, 100 sacks beans, 80 cans lard.
Do	Coast steamer Sara	*b* June 24	35 boxes flour, 20 half boxes and 2490 sacks corn.
Do	Bark Tres Hermanos	*b* June 20	Beans, flour, and corn.
Do	....do	July 14	156 tubs bacon, 200 sacks rice, 160 sacks corn, 129 barrels flour, 60 boxes meat, 65 boxes condensed milk.
Do	Coast steamer Victoria	July 13	237 sacks corn, 20 sacks peas, 100 sacks flour, 200 sacks beans, 5 sacks lentils, 12 boxes salt meat, 120 cans, 2 barrels and 4 tubs lard.
Do	Steamer Villaverde	*b* June 23	4785 sacks flour, peas, coffee, beans, corn, and rice.
Do	Brig Bujia	July 26	6 barrels lard, 438 sacks rice, 22 sacks beans, 200 sacks flour.
uevitas *a*	Steamer Saffi	May 20	125 sacks peas, 95 sacks rice, 186 barrels wine, 650 sacks salt, 60 boxes oil, 5 boxes cheese, garlic, hard-tack, and pepper.
Do	Steamer Franklin	June 11	2266 boxes flour, 284 sacks rice, 2693 sacks beans, 96 sacks spices, 50 sacks peas, 697 sacks corn, 72 sacks coffee.
Do	Steamer Chateau Lafitte	June 17	50 barrels codfish, 6 barrels soup, 3885 barrels flour, 9295 sacks flour, 5000 sacks rice.
ı Isabella (seaport of Sagua la Grande), *a*	Steamer Regulus	July 19	6573 barrels flour, 1000 sacks wheat, 4000 sacks corn, 450 boxes canned meat, 1000 barrels pork, 600 barrels hard-tack, 30 boxes groceries, 1 box quinine.
ın Cayetano	Steamer Prairono	*b* Aug. 8	400 sacks flour, 100 sacks rice, 100 sacks beans, 200 sacks corn, 272 tubs lard, 20 baskets garlic, 10 baskets onions.

a These ports were never declared to be blockaded.
b These ports were not declared to have been blockaded until after these dates.

Only four of the above-mentioned ports were included in the President's proclamation declaring ·rtain ports to be blockaded, viz. Cienfuegos and Matanzas on and after April 22, 1898, and Manzanillo ıd Batabano on and after June 27, 1898.

Out of the 22 instances given in the table of vessels entering Cuban ports during the war, there were ıt 9 of these which ran the blockade. O. N. I.

The above demonstrates once more how difficult it is to maintain a blockade even under the most favorable circumstances, as in this case, where the Spanish Navy did not make a single attempt to shake off the blockading ships. I am unable to say what part of the provisions mentioned in the foregoing table went to Havana; probably all those that were landed at Batabano, but

I have information from reliable sources that on August 12 the military administration of Havana had provisions on hand for three months longer, outside of what the blockade runners had brought into the country and what was hidden away in the houses of the city. One can therefore understand the indignation of Captain-General Blanco when he heard that the peace protocol had been signed. But of what use would have been a further resistance on the part of the Spanish garrison? The United States Government only needed to make the blockade more rigid. That would necessarily have sealed the fate of Havana sooner or later. A fortress in the ocean, cut off from its mother country, can be rescued only with the assistance of the navy. The enemy who has control of the sea need only wait patiently until the ripe fruit drops into his lap.

The lessons to be derived from the foregoing are evident and need no further explanation. May our colonies be spared the fate of Havana.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE LAST NAVAL ENGAGEMENT OF THE WAR.

By Lieutenant W. F. Halsey, U. S. N.

As a logical sequence of the surrender of Santiago, the necessity for blockading that port ceased to exist; hence began the gradual withdrawing of the vessels, and the fleet was anchored in Guantanamo Bay, forty miles to the eastward of Santiago. Vessels were coaled, temporary repairs were effected, and the crews were given a welcome relaxation from the strain of blockading service.

The troops in the vicinity of Caimanera had not been informed officially of the surrender of the province, and created occasional excitement by firing vicious but badly directed shots at the occupants of the steam launches as the latter were busily engaged passing from ship to ship. No damage was done, and the shots probably came from stragglers in search of food that were hidden from view on the western shore of the bay.

The plans for the Eastern and Covering Squadrons were perfected; vessels were coaled to their utmost capacities, and, in the case of the Newark, sixty tons were bagged and placed on deck. Information from the department of preliminary peace negotiations, with the order postponing the sailing of the squadrons for Spain, strengthened the belief that the end was approaching. Apparently all was not plain sailing, for rumors became rife of delays, the impression being that Spain was temporizing and was not yet prepared for peace propositions.

It was well known that the Isle of Pines and certain other portions of the southern coast of Cuba were favorite resorts for blockade-runners, the natural conditions existing in these localities offering great advantages for this work. To establish a base on the Isle of Pines to break up the blockade running, and thus to shut off supplies to Havana from the southern coast, was desired. For this purpose the commander-in-chief organized an expedition composed of the Newark, Resolute, Suwanee, Hist, Osceola and Alvarado.* The marines under Colonel Huntington broke camp and embarked on board the Resolute (Commander Eaton), and, in company with the Newark, sailed from Guantanamo at 4 P. M., August 8, the intention being that all vessels of the squadron should rendezvous off Cape Cruz.

The detailed plans of the expedition were, of course, not known save to the commanding officer, Captain C. F. Goodrich of the Newark, but it was generally understood that a decisive blow was to be struck, and that any reverses additional that the Spanish arms might suffer would tend to expedite the progress of a speedy return of peace. The condition of the small squadron was excellent. The green crews had been shaken down, and the experience gained had brought self-reliance and a familiarity with war operations that were everywhere apparent. The general health was very good, and officers and men were keyed up to a pitch of enthusiasm and energy that bespoke a successful result for the expedition. Stops were made off Santiago, to communicate with the St. Louis; off the wreck of the Colon to investigate the work of the wrecking steamer Senior; and about 2 P. M., August 9, the Suwanee (Lieutenant-Commander Delahanty) and Hist (Lieutenant Young) reported to the Newark off Cape Cruz.

Information, from a supposed reliable source, was brought by the commanding officer of the Hist to Captain Goodrich, that the forces at Manzanillo, consisting of about 4500 men, with all the shipping and the town itself, would surrender on the appearance of sufficient force. The senior officer in command found himself confronted with a condition that required immediate action;

* Note by Secretary & Treasurer giving displacement and batteries of ships.

Ship.	Displacement. Tons.	Guns in Main battery.	Guns in Secondary battery.
Newark,	4098	12 6-in. R. F.	6 6-pdr.
Resolute,	4175	———	2 6-pdr.
Suwanee,	700	2 4-in. R. F.	4 6-pdr.
Hist,	472	———	6 6-pdr.
Osceola,	571	———	2 6-pdr.
Alvarado	100	———	2 6-pdr.

with him was the entire responsibility, as communication with the commander-in-chief was impossible. It was plain that a decisive blow, with great moral effect, could be struck at Manzanillo; it was also evident that to take a vessel the size of the Newark, within bombarding distance of the town, was an undertaking beset with danger and possible disaster. The responsibilities were accepted, and the decision made to demand the surrender of Manzanillo. Risks were to be taken that in time of peace might be deemed inexcusable; war conditions demanded them, provided the necessary nerve and ability were combined; on this particular occasion the two qualities, so necessary, were largely in evidence.

The four vessels were disposed off Cape Cruz for the night to intercept any possible blockade-runners, and at daylight were joined by the Osceola (Lieutenant Purcell) and Alvarado. The latter gunboat, taken at Santiago, was one of a class built in England for Spain, to be used in breaking up filibustering expeditions from the United States. Lieutenant Victor Blue had been assigned command of the prize, and the Alvarado, cleansed and painted a war color, manned by an American crew, looked more like some dainty steam yacht than the really efficient gunboat that she was.

Shortly after daybreak the course was set for Cuatro Reales channel, and from that moment until the return of the squadron, exciting events followed in rapid succession.

Manzanillo, as the crow flies, is about fifty miles from Cape Cruz, but the distance by water is greater and the courses are devious. From Cape Cruz to the northward and westward extends a fringe of keys of various sizes; the bottom is most irregular, and of the currents no man is able to tell. Inside the outlying keys is the bank and large bay, or inland sea, of Buena Esperanza; this is interspersed with keys and threaded by numerous channels of varying depths. Ballandras channel, the shortest and most direct route, gave but 18 feet of water, and as the Newark drew 22 feet 3 inches, it was necessary to make the attempt by Cuatro channel to the northward and westward. The only available chart showing the approaches to Manzanillo was on one of the western portion of Cuba; this chart being on a small scale, our objective port with its surroundings occupied but a small part of the sheet. Experience had demonstrated that charts derived from Spanish sources were not always to be depended upon, and navigators had found that many errors as to coast-line, positions of important points and soundings, existed on the only charts that could be obtained. A small chart, taken from a Spanish survey, showed 5½ fathoms as the least depth of water in the channel to be attempted; this was most encouraging, but the information contained in the sailing directions issued by the U. S. Hydrographic Office, to the effect that Cuatro Reales channel was closed, was not reassuring. The Cuban pilot of the Hist insisted that 5½ fathoms could be carried through the channel, and the squadron headed for the entrance.

To those not possessing local knowledge, the keys in this vicinity have a strange similarity in appearance, and as the chart failed to show some that existed, and depicted others that neglected to appear, the difficulties of determining positions by bearings can be realized. In addition to this, the strange variance of the soundings obtained from those shown on the chart rather casts doubts upon the reliability of this important aid in navigating.

The Hist, with the Cuban pilot on board, was sent ahead, and following, in the order named, came the Suwanee, Osceola, Resolute and Newark, the Alvarado being kept close to the latter vessel. The leading vessels were directed to display the danger signal should the soundings fall as low as five fathoms. With the sun to the westward, the channel was entered and showed one buoy planted by the Wilmington on a previous visit; this was the only mark to indicate shoal water. From aloft in the fighting-top the varying shades of green gave no indications of shoal spots, but a peculiar tinge of brown, unmistakable when the sun was near the meridian, but difficult to see in the oblique rays, was a sure indication of dangerous shoaling. Once only was the danger signal hoisted by the vessels ahead; the Newark, under low speed, steered by the best helmsman in the ship, with leads going in both chains, passed in safety through this questionable channel with a least depth of 5½ fathoms. The first danger had been successfully passed; the squadron was inside the reefs, and at 7 P. M. anchored close to an uncharted island in this beautiful inland sea.

Apparently the necessity for a flag of truce had not been considered in the allowance, for the signal outfit contained no white flag, so quartermasters and signal boys were busily employed making these flags for the use of the squadron.

At 4.15 A. M., before daylight, the vessels went ahead with comparatively smooth sailing until the keys off Manzanillo could be reached. To buoy certain sharp turns in the channel as guides for the return trip, pickle kegs were thrown overboard and anchored. About 10 A. M. anchor was dropped three miles off Manzanillo, and the Hist was sent to Calecto, six miles from that place, to communicate with the Cubans, and to request co-operation in the event of a bombardment.

From the ship it was difficult to discover the defences of the town; a line of fortifications was visible, block-houses and rifle-pits were easily made out, the wrecks of gunboats and transports destroyed in a previous bombardment were seen, but the actual positions of the guns were unknown. A chart prepared by Lieutenant Young of the Hist gave the number of the guns that took part in a previous action, and, with this, the general positions were located with fair accuracy. The town itself straggled along the water-front, the houses being built on the land that rose from the sea with a gentle slope inland. Several keys divided the entrance, giving channels to the northward and southward. Both channels, however, were far too shallow for the Newark; in fact, the lack of water precluded any manœuvring on the part of that vessel. It would be necessary, in the event of a bombardment, to run in as close as possible and to keep heading in one general direction, as the room for turning was decidedly limited. Before anchoring, the Newark hoisted a flag of truce, and the Alvarado, flying a white flag, started for Manzanillo with the following communication:

"U. S. Newark,
Manzanillo, Cuba, Aug. 12, 1898.

To His Excellency the Military Officer in Chief Command of Manzanillo, Cuba.

Sir:—I have the honor to present my compliments to your Excellency and to make, in the name of the United States, the following demands:

1. The unconditional surrender of Manzanillo and its dependencies with all the Spanish forces therein, military and naval, regular and volunteer, civic guards and firemen; also of all vessels of every description now afloat in the harbor, the latter to be delivered to me intact and uninjured. Also of all guns in the fortifications, with their ammunition,

mounts and appurtenances; all field guns with their carriages and caissons, as well as ammunition and equipments, all in efficient condition.

2. The police and fire departments to deliver up their arms, but to continue on duty as before.

3. The civic authorities will retain the exercise of their functions during the pleasure of the United States.

4. All lights, beacons, buoys, and other aids to navigation shall be established as before, and the authorities, both civil and military, must assist to the utmost in replacing and establishing any buoys that have been removed. The light on Cape Cruz shall be immediately lighted and maintained. The charge for the same shall be borne by the United States.

5. Public property of every description belonging to His Majesty, the King of Spain, shall be turned over to the custody of the United States. Seals and guards shall be placed by you upon any such property which is liable to pillage or destruction.

6. All telegraph lines, instruments and offices shall be kept by you intact and handed over to me in perfect working order.

7. As the religious authorities will be left undisturbed in the exercise of their holy office, they will be expected to diligently and actively exert their influence to preserve order and quiet.

8. If the foregoing conditions be accepted and carried out in good faith, the same treatment and disposition which was granted the Spanish troops at Santiago will be extended to the forces surrendered by you.

9. These terms must be accepted immediately. If you decline them, then I pray your Excellency to immediately notify all women and children, and other non-combatants now present, of my intention to bombard and assault Manzanillo within three hours from the moment of handing you this communication. Upon your Excellency's head will rest the grave responsibility of causing needless bloodshed. Begging your Excellency to accept the assurance of my distinguished consideration,

I am your obedient servant,

C. F. Goodrich,
Captain, U. S. Navy,
Commanding the United States Naval and Military Forces Present.

Delivered at 12.35 P. M.

Victor Blue,
Lieutenant, U. S. N.

Manzanillo had been subjected to attacks before this, for on two occasions the Helena, Wilmington, Scorpion, Hist, Osceola and Wompatuck had bombarded the town, sinking and destroying several gunboats and transports. The place offered advantages for running the blockade, and while its inhabitants had been brought face-to-face with warlike conditions, they had not yet experienced the effect of a six-inch shell and smokeless powder. To the Spaniards it must have appeared the irony of fate to have this ultimatum delivered by the captured gunboat Alvarado. From Lieutenant Blue it was subsequently learned that his reception was courteous, the guard was paraded in his honor, and the Spanish officers were very curious to know whether the Alvarado had come from Guantanamo under her own steam or had been towed by the Newark; apparently the trip for so small a vessel was, by them, considered a serious undertaking. The Hist returned from the interview with the Cubans, and brought the information that reëforcements had reached Manzanillo. At 1.10 the Alvarado steamed alongside, and the excitement on the Newark was intense. Was it peace or war? Would the Spaniards fight or surrender? Nothing could be told from the usually impassive face of Lieutenant Blue as he came on board and retired with the captain to the cabin. The order to clear ship for action, and the hoisting of that signal to the other vessels, dispelled all doubts. The Spaniards would fight; they thought the time allowed was not long enough, and their commanding officer was quoted as saying that their code did not permit a surrender unless actually beleagured by land and sea.

The order to clear ship was a welcome one, and the work was done quietly and thoroughly. All boats were lowered and towed out of range of gun fire. The men seemed overjoyed at the prospect of another fight, and appeared as if looking forward with pleasure to the prospect of killing or perhaps being killed. At 3.20 the Newark signalled to get under way. General quarters was sounded, and the usual preparations made, with officers and men at their stations. The executive officer on the main deck, junior officer in top to observe fall of projectiles, captain, navigator and Cuban pilot on upper bridge, chief quartermaster and signal boys on lower bridge.

Before leaving Guantanamo Bay the Newark had received from the public school children of the city of Newark a box containing a set of colors consisting of pennant, jack and two large ensigns, one of the last-named being of silk. These ensigns had been rounded up to the masthead, the silken one forward; and at 3.35 P. M., three hours after His Excellency had received the demand to surrender, the white flag was hauled down and the battle-flags were broken. At 3.40 the general signal, "commence firing," was made, and at 3.41, with a range of 5000 yards, Lieutenant J. H. Gibbons fired the forward 6-inch on the Newark, and the fight was on.

Until the firing of the first gun the men had been noticeably quiet, the ship seemed unusually still, accentuated by the action of the elements that, apparently, had determined to have a share in the noise. Heavy clouds had banked to the northward, and a rain squall, with vivid lightning and rolling thunder, hung over the town. It was not the intention to damage the defenceless portion of the town, provided it could be avoided, and to this end the divisional officers had been instructed as to the objective points for gun fire. That the place was fortified was evident; sufficient notice had been given to effect the removal of non-combatants, and no consideration of possible injury to private property could deter the commanding officer from the plain duty of bombarding Manzanillo. The first shot was a good one, and after waiting to observe the effect of the shell, the several guns of the starboard battery were soon engaged. There were no failures of the electric firing attachments; the electric ammunition hoists, running at less than full speed, supplied all ammunition that could be used; the smokeless powder left no lingering cloud to bother the gun captains in looking over the sights, for before the gun could be reloaded the little smoke caused by the discharge had been dissipated. The shooting was excellent, clouds of dirt showed where the shells had struck and exploded about the trenches and at the block-houses on the hills. It was desired to head as much as possible in one general direction to use the starboard battery; the narrowness of the channel prevented any material change of course, and the report of five fathoms from the lead caused the Cuban pilot to shrug his shoulders and to intimate that the ship should go no closer. To the suggestion made that four fathoms would leave a margin of a few inches under the keel, the pilot walked to the end of the bridge, indicating that he washed his hands of all further responsibility. Slowly the Newark steamed ahead, stopping when the lead gave 4½ fathoms; the propellers did not have the full effect with the scant water, and though the engines were backing, the ship slipped ahead; the starboard anchor was then dropped, at the same time slowing the vessel enough to avoid all possible danger from touching the anchor. When headway was stopped the anchor was hove up and the Newark backed out to five fathoms, going ahead again and anchoring in 4¼ fathoms; this operation was repeated, and by this means the range was altered but little, and the change of train of the guns was small. About five minutes after the firing of the first shot, the gunboats had passed through the middle passage about a mile distant from the Newark. The Osceola opened fire first, followed by the others. The Alvarado, that had been directed to take position off the port bow of the senior officer, joined in the fray, and the action became general. The hail of projectiles was merciless, and yet the Spaniards had not replied. At 4.17 it was thought on the bridge of the Newark that a white flag had been shown on shore and the order to cease firing was given. It was supposed that the Spaniards were satisfied, and the Alvarado, flying a white flag, was sent in to receive the surrender. The gunboat fire was stopped, probably following the example of the senior officer. The Alvarado, eagerly watched by those of the large ship, had arrived within about five hundred yards of the shore, when there was a flash from one of the batteries and immediately the water-front was lighted up by the continuous discharge from the Spanish guns. The gunboats were not taken by surprise, and they were soon clouded by smoke from their batteries. The men on the Newark, who had been resting during this interval, ran to the guns without orders; to those on the bridge it seemed as if the white flag had been fired on. Unfortunately the gunboats were so close in that it was impossible to fire over them and reach the batteries. The small vessels, making a gallant fight of it, bunched to the right out of the line of fire, and the Newark was enabled to resume operations. The general recall was hoisted, and, firing as they steamed slowly out, the gunboats returned and passed under the stern of the Newark. The fire of the Spaniards continued, but their shots were wild. It seemed a miracle, upon receiving the reports of the commanding officers, to learn that not one of the gunboats had been struck; one shot went through the flag of the Suwanee, and though that vessel had grounded and was close to the batteries, she was not damaged in the slightest. Lieutenant Blue reported that the Spaniards had fired on the flag of truce; that he hauled it down and returned their fire, but as his ammunition was Spanish only about one-third of it was effective, so he had armed his crew with Mausers and thus engaged the batteries and troops. It was afterwards concluded that the Spaniards seeing the Suwanee, Osceola and Hist approaching without flags of truce flying, had done the proper thing and opened on these vessels. Subsequently it was learned that no flag of truce was displayed at this time. The gunboats anchored, and, until dark, the Newark fired an occasional shot, being replied to by the southern battery, the shots from the latter flying wide. Before dark bearings for firing were taken, and orders were issued to fire during each half hour one shell on bearings from SE. by E. to SE., the intention being to renew the action at daylight and to land the marines. At about 5 P. M. a line of smoke showed that our Cuban allies had begun an attack from the NW.; to this the Spaniards replied with field-pieces, and at 5.30 the Cubans withdrew or ceased firing.

There had been little rest on the ship for the last forty-eight hours, and at dark the watch was set, the officer of the deck firing the guns with the watch on the given bearings. The crack of a six-inch gun is not conducive to sleep, and while it was trying to those on the ship, it must have been particularly nerve-racking to those that were being fired at in the darkness at irregular intervals. About 2.30 in the mid-watch a boat with numerous lanterns was seen, but as no chances were being taken, the six-pounders were opened on the lights and they disappeared. At daybreak white flags were seen in all directions and the Newark's fire ceased. A boat flying a white flag and containing two very sad-eyed and weird-looking Spanish officers, brought to Captain Goodrich the department's despatch announcing the signing of the peace protocol. No reliable data was obtained as to the damage done by the bombardment, but it was learned that the last shell fired had exploded in a portion of the barracks, killing six soldiers and wounding several others. Communication was opened by telegraph with the commander-in-chief, and by his orders the squadron returned to Guantanamo.

Pertaining to this engagement is a matter of history that deserves more than passing mention. A few months after the events described had occurred, the Hist again visited Manzanillo, this time with peaceful intent. It was learned from the military commandant, that at dark on the night of August 12, a council-of-war was called of the senior Spanish officers at Manzanillo, and by them it was decided to surrender unconditionally to Captain Goodrich. The official communication was drawn and signed, and was to have been delivered when daylight should render a white flag recognizable. Before dawn came the telegram announcing the suspension of hostilities. The Spanish military commandant was spared the mortification of a surrender, while the naval commander of the American forces, with the prize within his grasp, was unable to reap the fruits of his daring undertaking.

Though this fight took place practically after the signing of the peace protocol, of course unknown to the senior officer, the expedition was not barren of results. It must have impressed the Spaniards with the fact that the naval forces of the United States were on business intent. To the subordinate officers and men of the small squadron it was a most instructive object-lesson. The calm, nervy, assumption of responsibility by the commanding officer; the skilful handling of so large a vessel in dangerous waters, the thorough preparedness for attack and final engagement, were experiences that will make lasting impressions on those that took part in the last naval engagement of the Spanish war.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME EXPERIENCES ON A U. S. NAVAL TUG-BOAT.

By Ensign W. S. Crosley, U. S. N.

Having been requested to "ship" under a new rating and enter the lists as a narrator, it is with great misgivings that I submit herewith an account of my wanderings and doings as one of that class of American naval officers known during our war with Spain as "tug-boat skippers."

The title of "captain" could scarcely be bestowed upon one who, from necessity, more often resembled a canal-boat deck-hand in uniform than a naval officer of any nationality.

To begin at the beginning: When I reported to the New York Navy Yard on April 1, 1898, with orders directing me to report for duty as watch and division officer on board the U. S. S. Mayflower, I found that an "April-fool" had been prepared for me, and that I was to fit out and command the U. S. S. Algonquin. Not having the slightest idea what that vessel might be, I instituted a few inquiries, and, that evening, I beheld for the first time my future command, which turned out to be the old Morgan Line tug, El Toro. I wandered on board, and soon discovered that the "fitting out" would mean to supply her with everything, from a paper of tacks to a hawser or two.

A few more inquiries resulted in the information that there was no crew available for the Algonquin; however, I was also informed that she must be fitted out and gotten ready for sea at once, so steps had to be taken immediately.

Having required for a modest (?) amount of stores and obtained them, the next dilemma was how to get them from the store-house to the boat.

I saw a very desirable-looking two-horse truck passing just then with "U. S. N." in letters on the harness. The driver of that truck received sudden and unexpected but peremptory orders from me to go at once to the store-house delivery room and load stores. He replied, "Can't do it, sir, I have orders . . . ." when I interrupted him with "Have you any orders later than mine just given you?" He said that he had not, and, after some language had been spoken, he was in a proper state of submission.

The stores were loaded and taken to the dock, my long-unused muscles receiving some severe shocks during the loading and unloading. A vain effort was made by me to secure a working party for this work, so nothing remained to be done but for me to work myself, since the pay of an ensign does not warrant the employment of many laborers.

The stores were on the dock, the truck gone, and the boat handy, but I was really too tired to put them all on board myself, and had but just informed a sentry that, though I did not wish to give him any orders, the stores I was about to leave on the dock were government property and it might go hard with him if they were disturbed. Fortunately he was Irish, and, with a twinkle in his eye, replied: "Ah! roight sor, I'll watch 'em!"

I was off to beg a bite to eat, for it was past noon of April 2d, when a squad of enlisted men from the "Vermont," in working clothes, appeared, bound for the Cob Dock Ferry. Here was a chance too good to be lost. The petty officer in charge of that squad had an experience similar to that of the truck driver, but the stores were put on board the Algonquin, and while this was going on I made use of the telephone nearby to submit a request to the Vermont, that the dinner for the working party be saved, explaining what they were doing.

Something must have happened to that telephone wire just then, for a most confused sound came to my ear, not unlike broken profanity, but, as the next thing I caught was about "these trade-dollar Captains," I decided that there had really been no profanity, and was further relieved when I made out "All right!" in tones I recognized as belonging to Lieut. H. H. Hosley, U. S. N.

Having reported to the commandant that the stores were aboard, I was informed that some men would be over from the Vermont, and that the boat would be put in commission at two o'clock.

This was all done, and I think six as verdant-looking men as I ever saw appeared. After the function was over they were told to stow stores, and their nice new mustering-clothes soon became worthy of a tug-boat. So much for fitting out.

Additions to this crew soon came aboard, and, with the exception of a man who could run engines, I was told I was all fixed in that respect.

A machinist was borrowed, however, and, with the compass officers on board, the Algonquin went out in East River to adjust her new compass. I have never learned just exactly what the ferry boat captains thought that day, but from their expressions they surely thought the Algonquin had run amuck.

The night of April third, as I was leaving the boat, a portly man in bluejacket's uniform, and wearing a very large smile of welcome, met me and said, "Are you Cap of this yere boat?"

He was informed that such was the case, when a large hand was put out with the remark, "Well, Cap, I'm glad to see yer, I'm yer Chief!" It took me nearly a minute to ascertain that the "chief" had never been to sea.

This addition was followed by the arrival of a mate, aged sixty-one years, who informed me that he had not been to sea for twenty-five years. He had orders to report for duty on the Algonquin, and was to assist (?) the commanding officer in navigating her to Key West.

The crew was now considered complete, though only two of the men had been in the Navy before, and only four had been following the sea. We coaled and took ammunition; then, in the afternoon of April fourth, started for Key West.

The Nezinscott, another converted tug, commanded by Lieut. York Noel, U. S. N., followed the Algonquin out of the Navy Yard, but the usual "something" happened in the Buttermilk Channel, and my last sight of her at that time showed her heading for the Brooklyn wharves. There was no reason why I should wait for the Nezinscott, so the Algonquin was headed for Scotland Light Ship, reaching it about eight P. M.

At ten o'clock I turned in, with instructions to the mate to call me at two A. M., but they were not necessary, for about that time I was thrown from my bunk, and awakened to the fact that the Algonquin was in trouble. That trouble continued, growing worse, till twelve hours later, when we anchored behind the

Delaware breakwater to rest, and to pump her out—a light one-inch pine hatch-cover having failed to keep out several big seas.

When a smooth time came, twenty hours later, we started south again, and reached Port Royal just in time to allow the Nezinscott to catch us.

We left Port Royal in company and met more weather; it was decided that, the Nezinscott being larger and faster, better time could be made if she towed the Algonquin. This worked very well till the Nezinscott broke down, when the poor little Algonquin had to tow her till the fleet off Sand Key Light was sighted, on the morning of April thirteenth.

After resting at Key West, and patching up the Algonquin, we started a trolley service to Havana and return. We towed captured schooners, carried dispatches and provisions, and once—started to take some laundry over. . .

I have always considered that the owners of that laundry were fortunate in *one* thing—that is, they were able to learn what had become of it, for the Algonquin tried very hard to sink on that trip, as she had tried before. It has been reported that the laundry was thrown overboard. This is not the case. One of the many seas which swept entirely over the Algonquin carried away laundry boxes, lashings and all. This, too, when these boxes were lashed on top of the deck house.

On that trip the Algonquin left Key West under protest, so heavily loaded with stores and provisions that the water came up through the scuppers and flooded the water-ways when she was in still water in the harbor.

It is due to Captain R. D. Evans, U. S. N., of the Iowa, that the Algonquin ever reached Key West that trip, for she was rapidly filling, and I had picked out a nice soft spot in Cuba to beach her, hoping to attract the attention of one of our blockading vessels before I attracted the attention of any overzealous Spaniards.

While the Iowa towed us to Key West, all hands on the Algonquin, including her commanding officer, were busily engaged in throwing dirty, black water out of her. The decks were open, the seas went into the bilges by way of the coal bunkers, and the pumps refused to work when called upon to eject coal and water mixed.

We went to a dry dock at the Key West Naval Station, with about a foot of water under the keel, tied up, and all hands went to sleep. By actual count I had not slept for fifty hours, and my sleep previous to that had been most broken. I slept sixteen hours during that first nap I took in Key West, and enjoyed the sensation.

A member of the fleet staff had suggested to me that I take the tug Leyden, which was well known to be a good sea boat, but was as yet unarmed. That seemed to be a most desirable change, but when I awoke from one of my prolonged naps, the New York had sailed for Porto Rico. Here was another dilemma.

The commander-in-chief had declared the Algonquin to be unfit for the duty upon which she had been engaged. It was evidently the intention of those in authority that I make an effort to command the Leyden. That vessel was useless without guns of some sort, but I soon learned that two three-pounders had been sent to Key West for her. In the same shipment came two six-pounders for another vessel, and they looked to me to be much more desirable than the smaller guns. The night was dark, and in the morning the tags marked "For the Leyden" were found upon the larger guns.

That seemed to be a good start, so, with the approval of the senior officer present, I telegraphed the state of affairs to the Secretary of the Navy, and was much pleased when a return telegram placed me in command of the Leyden.

Two six-pounders did not seem enough for a five hundred-ton boat, so I looked around for other guns, but the largest I could find was a six mm. Colt automatic, which really went very well on top of the pilot house.

Guns were very scarce at that time, and when I counted my new crew I found just half enough men to man those guns that I had.

Men were scarce also, but I found a few, and they became additions to the Leyden's crew.

One man I had borrowed while on the Algonquin. He had been a watertender on the torpedo-boat Porter, while I was serving on that vessel, and his capabilities were well known to me, so that, when I saw him in Key West, a convalescent living in the Marine Hospital, I decided that I needed his services more than they were needed on the Porter, that vessel having gone to Porto Rico with complement filled.

With faith that the Surgeon in charge of the Marine Hospital knew little of naval red tape, and feeling sure he did not know the tonnage of the Algonquin, I informed him *by telephone* that I needed this man at once, and hoped that he would send him down immediately. There were, of course, some objections, but apparently my voice did not betray my lack of age and rank, for I got the man, and a good stroke it was. I considered that I owned that man's services, so took him with me to the Leyden and he never made me feel other than very glad I had done so.

My first duty on the Leyden was thrust upon me at two o'clock one morning, when I was suddenly ordered to the Cuban Coast to deliver dispatches to a flag officer.

None of the authorities in Key West knew where this flag officer was to be found. Neither did I. Upon asking what coal, water and provisions I would require, I was informed that I would surely be back within three days and need take none, so I went without them, since one can't well deal with Key West merchants before daylight. The next time I entered Key West harbor was just twenty-two days from that day.

Proceeding off Havana, I found that the commodore had gone to the eastward, but no one knew how far, or for how long, so east was the next course till off Matanzas, but still no flagship or knowledge of her whereabouts. We spoke the senior officer's vessel here and again started east. It was an exceedingly dark night, and we were fortunate indeed in picking up a vessel off Cardenas which proved to be the Dolphin, with the commodore on board, otherwise we might have "gone east" for some time.

I was asked how long I could remain on blockade duty, and replied not longer than a week, since I had neither coal nor water for longer, not having been able to obtain them. This seemed satisfactory and the Leyden was ordered to relieve the Foote in the blockade of Cardenas.

I was fortunate enough to find the revenue cutter Hudson here, and learned much of the surroundings from Captain Newcomb in the one day he was left on that station.

After the Hudson left all went on with the usual monotonous blockade routine till my week was nearly up, and no sign of a relief. In the meantime I had formally taken possession of Piedras Cay, and an enormous American flag was flying from the light-house thereupon.

A well-filled cistern relieved the water question and, instead of "battery instruction," the Leyden's crew had constant boat drill, incidentally bringing on board about ten thousand gallons of fresh water, also an iron water-tank which increased the fresh water capacity by five hundred gallons (also some other things).

The coal was carefully nursed, but the provisions were nearly expended, so we led some live stock to the slaughter. Fresh pork, mutton (goat!) and chickens were indeed luxuries, but we found all these, and borrowed them, too.

We would have been willing to pay for them, but our accounts were in Porto Rican waters, and we had no money; besides, the owners did not, after the first round, seem at all inclined to come close enough to receive payment. Some starving (?) Cuban officers furnished us with some very acceptable beef, also, which had recently been Spanish property.

In time, both food and coal gave out. A collier came along at an opportune moment and saved us a trip to Key West for coal. Mono Cay, and the birds' eggs thereupon did the rest. (Sea gull's eggs are good when there is nothing else to eat.)

During these days many attempts were made to decoy the Spanish boats in Cardenas Harbor within range, or to catch them outside. There were only three of them left, since the fight with the Wilmington, Winslow and Hudson, and none of them were smaller than the Leyden, so it must have been that they considered one little armed tug beneath their notice.

Not a man in the Leyden's crew had fired a six-pounder, or knew anything about such a gun when we sailed from Key West. By this time each gun-captain knew that he could hit a block-house every time, their course of instrutction in this particular having been entered in the log as "target practice upon Spanish block-houses along the beach."

We were fortunate enough to pick up a small boat filled with Cubans, one, Senor Ernestro Castro, being a messenger from the Cuban Junta on his return trip to the States, the others being Cuban officers and soldiers.

One of the officers, Captain M. F. Rubalcaba, was a man of most pleasing personality. A residence of eighteen years in the United States had done much for him in this respect, and we became fast friends. Through him I established communication with the Cubans ashore, and was able to get much valuable information from them. Captain Rubalcaba was a capital pilot for those waters, having owned a yacht, and knew all the block-houses which had no ordnance. He was most delighted when a shot fired by him demolished the roof of a block-house and scattered the pieces over a squad of Spaniards.

During this time the Leyden received a few scars, but no one was hurt, and the practice proved of great value to the crew. The men developed a very comforting contempt for Spanish marksmanship.

When the collier's offering was nearly used up nothing could be done but go to Key West for coal. I had at last decided that the Leyden was forgotten, and consequently would not be relieved.

Before I was obliged to leave, the Uncas, commanded by Lieut. F. R. Brainard, U. S. N., joined company from Matanzas, and Spanish block-houses on our beat grew scarce. We were informed by our Cuban friends that the Spaniards were most anxious to catch us, but they must have been waiting till another American vessel joined us, so the fight would be even, for the three Spanish boats kept well out of our way.

The Cubans also told us that we had hurt a great many Spaniards, some so badly they never felt it, but of course this was unintentional on our part, for we considered it all as only necessary target practice.

After the Uncas left, knowing that I must also leave the next day, I made a last effort to trap the Spanish boats.

I had learned from the Cubans that these boats came out every night to the channel through which the Wilmington, Winslow and Hudson had passed, and were engaged in filling this channel with obstructions.

It had been the custom for the Leyden to snugly anchor at Piedras Cay by day, light a deck lantern in the light-house in the evening, then stand by with anchor up to see that no one put the light out during the night. The morning in question at three o'clock, when it was very dark, the Leyden steamed in as close as possible off the western end of Cay Blanco, and, lying hove to in two fathoms of water, waited for daylight, all hands standing by the guns. With the first glimpse of day we saw our Spanish friends, just within range, but they did not stay there long. Some flying splinters on board one of them showed us a hit. but more we could not see. Our misfortune lay in drawing eleven feet of water and not having that depth in which to chase them.

It was with considerable disgust that we started west, also with enormous appetites. There were seven tons of coal in the bunkers, four tons of which were necessary to reach Key West under the most favorable conditions. We got in all right, but the Key West Hotel did not make money by having me as a guest at that first meal I took.

We stayed in Key West just long enough to fill coal bunkers, water-tanks, and provision lockers, when we departed for our Cardenas beat. It seems but fair that I should here mention some additions to complement and armament which were accumulated at this time.

I found another gun; this time it was a Maxim-Nordenfeldt one-pounder, automatic, and it filled a long-felt want. A four-inch gun would have been more acceptable, but there were reasons why we did not get one—one reason was that I could not find any; another, that it would have been difficult to get it on board unseen.

Those officers who have served in " one-officer boats " will appreciate my delight when I learned that a commissioned officer had been ordered to report for duty on the Leyden. When he reported, and I discovered that he had never seen a sea-going compass, I had some misgivings. Unfortunately they were more than warranted, and this officer did not remain in the Leyden any longer than was necessary.

While on the blockade it was my custom to chase everything sighted till certain of the identity of the stranger.

Upon our return to Cardenas, one evening just before dark, the New York, with some small vessels, had gone to the eastward, and been chased by the Leyden till their identity was unmistakable. Shortly after turning about for the Cardenas beat, a strange vessel, with two military masts and two smoke-stacks, was seen to the westward, heading our way. That looked like one of those breaches meant for tugboats, and a course was set to intercept the stranger. Imagine our disgust when we read her number, and realized that we were looking at the U. S. S. New Orleans for the first time.

A few nights after, when a season of unusual quiet had made us anxious for an exciting chase, with a possible prize at the end of it, a light was seen to the northward. We gave chase and lost the light; keeping our course the light was seen again to the eastward, and away we went after it. This was about eleven o'clock, and we chased that fellow till one A. M., seeing his light at intervals. When it seemed that he must hear a shot a "blank" was fired. Soon after that there were plenty of lights, and I was able to make out a *pair* of top lights. More dilemmas. If it were a steamer trying to escape the top lights might be a ruse; if it turned out to be a man-of-war, then I might get into trouble.

The former solution seemed possible, and, as she did not seem to slow down, a shell was fired directly over her. That had an immediate effect, for we could see that her helm was put over, and she swung around, showing a natty looking man-of-war, which I recognized as H. B. M. S. "Talbot," now within hailing distance!

There was some conversation between the two vessels by aid of megaphones, at the end of which I apologized to the commanding officer of the Talbot, but stating the necessity of learning the identity of his vessel; then it was "hard-a-starboard," and back to Cardenas.

Though the Leyden had made her best speed, fourteen knots, while chasing the Talbot, she made scarcely ten knots on the return trip, all hands below as well as on deck, being fairly disgusted at the thought that the episode was only another case of fancied prize which had vanished in thin air.

Some days we overhauled and boarded as many as five vessels, but no prizes came our way. Shortly after the Talbot affair, while steaming slowly off Matanzas, in a rough sea, an unusually heavy sea caught the Leyden's stern, and the quartermaster at the wheel reported it jammed. By going over the stern in a bowline, and getting a good soaking for my pains, I discovered that the balanced rudder was badly bent, with almost a permanent hard-aport helm. The nearest American vessel was off Havana, and it would not be easy to get there.

By towing an empty barrel at the end of a long hawser, by use of the fore-and-aft sails, and by stopping to get a fresh start occasionally, we managed to reach our vessels just at dark. Our course down the Cuban Coast that day was an affair of scallops, and we covered many miles to make good a few.

Heaving to, off Havana for the night, the Machias towed us next day to Key West, where we spent two days "borrowing" lumber, and rigging a jury rudder.

The converted yacht Oneida was in port, bound for Mobile, Ala., to repair boilers. The Leyden must go to the same place to be docked, so an arrangement was made whereby we might assist each other. The Oneida made fast to the Leyden's quarter, and we finally got out the Northwest Passage to Key West harbor, but Lieutenant Miller and myself learned much on the way out.

Towing the Oneida by two lines, the Leyden averaged ten knots, and we anchored off the entrance to Mobile Bay at night, with all available lights burning, and the private signal for the day showing. This was to convince the forts that we were friends, but, as I learned later, we were nearly fired upon for our pains, the reason being that our lists of private signals (the latest issued) did not correspond with the list at the fort.

The trip up the "ditch" to Mobile was quite exciting, but we finally tied up to the dock, and began to interview dock-masters.

The Leyden was docked, the rudder removed and straightened, a new shoe was put on, and the rudder replaced. Better or faster work of this kind I have not seen, and in six days we were again bound for Key West.

Mobile offered new opportunities to obtain men, and two splendid additions to the crew were made.

Upon arriving at Key West I received orders to prepare for a trip to Santiago, and within twenty hours all was ready. We sailed as part of a convoy, the Leyden towing an unmanageable transport named the Unionist. A large part of the time we were towing the bight of the hawser, for it seemed that the transport could not possibly steer a course.

All went fairly well, and we kept ahead of the slower transports till we struck heavy weather, then the fun began. Finally, we had to cast off the tow line and stand by the Unionist. The other vessels disappeared ahead, but we finally got the Unionist around Cape Maisi, and caught the convoy off Guantanamo Bay, going that night to Siboney.

The next day began the most unpleasant and wearing duty yet thrust upon us. Several hundred troops, all volunteers without visible discipline, were landed, as well as many car-loads of stores, and it was a great relief when we were ordered to transport fifty thirteen-inch shells from the St. Paul to the Oregon. Thirteen-inch shells are easier to handle than volunteers whose officers will not help.

Leyden was the only craft of her kind available, and for five days it was a case of "all hands," night and day, till we were in a state of physical collapse. I doubt whether a soul on board slept three consecutive hours during that time; I know that I did not. One night, in the hopes of getting a good rest, and in fancied security, the Leyden was anchored at Siboney with two anchors, one having proved insufficient to hold her.

I had just gone to sleep when a squall came along, caused two transports to drag their anchors, and a flash of lightning showed their sterns on either beam of the Leyden and drifting together. To stop to get the anchors would be suicidal, and we could not spare them, so the "jingle bell astern" was rung, and we slipped out between those transports just as they came together and sawed a few pieces of the upper works out of each, also smashing a boat astern of one of them.

The Leyden's stern was now in fourteen feet of water, with quite a swell running, and the rocks about fifty feet away. It was not a good place to stay.

We finally got those anchors in sight, and they were *foul.* One had dragged over the other, so securely locking their flukes that several hours of work by dark, in rough water, could not even loosen them. The derrick was rigged, the tangled mass of anchors and chain hoisted aboard, lashed to the deck, and a few of the men had some sleep before daylight. We cleared the anchors all right, but such incidents were not needed to keep us engaged, and we resented them.

A bit of a yarn is told upon me by a naval officer who was a passenger on the Leyden at that time. While engaged in landing troops, at the end of one day when I had been especially harassed, I had made vain appeals to the officers of the volunteers to take charge of their men, and direct them in the disembarking.

It seemed that the men were in no particular hurry to get on shore, so I took charge of them. While I was "taking charge" one of the volunteer officers asked my passenger: "Is the Captain of this boat a graduate of the Naval Academy?" Upon being informed that such was the case, he remarked: "Say, he is awfully profane, isn't he?"

SINKING OF THE SPANISH CRUISER JORGE JUAN BY THE U. S. S. LEYDEN AND THE U. S. S. WASP, BAY OF NIPE, CUBA, JULY 21, 1898.

TAKEN FROM U. S. S. LEYDEN.

The small boat under the Stern of the Sinking Vessel is the Leyden's gig, recovering the Spanish Colors.

Captain Steele, of the First Illinois was a marked exception among the volunteer officers. He proved to be of such great value in the landing that he remained on board as my guest till I had finished with his regiment. He acted like a naval officer.

Finally, our unthanked efforts in behalf of the Army ceased, because there was no senior naval officer present, and I went to Santiago, reporting to the commander-in-chief.

It was with great joy that I received orders to prepare to join an expedition to the Bay of Nipe, though as much fun as developed was scarcely anticipated.

The Annapolis, Wasp and Leyden left Guantanamo Bay in company and finally arrived off Nipe Bay, finding the Topeka outside.

My orders read that I was to assist in removing mines at the entrance to that bay, instead of which I was asked if I would enter the bay. Of course I desired to do that, and was greatly disappointed when I saw the Wasp coming after, evidently bound upon the same errand. Later I was glad enough that Lieut. Aaron Ward and his Wasp were so near, for the first thing I saw when I could see around the headland was a vessel flying the Spanish flag, and pouring black smoke out of her smoke-stack. The water was absolutely smooth, and the conditions favorable to a mirage, so the Spaniard looked somewhat larger than the U. S. S. Iowa.

Communicating with Lieutenant Ward by megaphone, we decided that she did not look too big to try, at any rate, so we tried.

Our six and one-pounders did considerable damage, as we could plainly see, and some shots from the Spaniards fell so close to the Leyden that water was splashed aboard. One shot passed through the Leyden's awning, but when the Annapolis and the Topeka came in the Spaniard was sinking, and there was but little for them to do. I was fortunate enough to get alongside the enemy before she sank, and secured her colors and her Jack.

Thus ended the Spanish Cruiser Don Jorge Juan, though some few relics from her are now in different parts of the United States.

We saw no mines while entering Nipe Bay, for I believe we steamed too fast to see them, but on coming out, and upon entering at a later day, we counted five, similar to those recovered at Guantanamo Bay, in an exceedingly narrow channel. I don't know just why we did not hit them when we went in the first time, but I think luck was with us.

From Nipe Bay the Leyden was ordered to accompany the monitors Puritan and Amphitrite to Cape San Juan, which she did, stopping at Cape Haitien with them to coal.

Upon reaching the rendezvous at Cape San Juan, we found that it was for us alone. There were no transports there, except two, which, I believe, claimed to be lost, and after a wait, the Leyden was sent to St. Thomas to communicate with the Department.

After twenty-four hours' stay and no reply to the telegram I had sent, the air pump broke down officially, and, though not less than one hundred pounds of steam were ready at all times, and not less than half the crew awake always, that air pump did not recover (*officially*) till the telegram from Washington came.

An incident happened at St. Thomas. A Danish official, with whom I was on the most friendly terms, informed me privately and unofficially, after a two days' stay, that the authorities knew what I was waiting for, and that he firmly believed they would hold the Leyden till the war was over, unless she went out the next day. I asked: "Hold me with what?" He pointed to the Danish Cruiser "St. Thomas," lying in the harbor, and looked quite dumbfounded when he was informed that the Leyden would not go out till her air pump was repaired, and that, if a hostile move were made on the St. Thomas when she did go out, the effect of five hundred tons, travelling at the rate of fourteen knots per hour, and suddenly stopped, would be fully demonstrated.

All hands knew just when the Leyden would sail, but no effort was made to stop her.

Returning to Cape San Juan with information from the Department to the senior officer present, the Leyden was left there with the Amphitrite, the other vessels going to Ponce.

The Leyden was detailed to lie close in shore, near the Port of Fajardo, in water too shoal for a larger vessel, and communication was established with the natives. The Spanish troops had left, but there were rumors that they were returning in force. These rumors were verified, but we could not learn the exact numbers of the Spaniards, and, as a body of men from the Amphitrite, under the command of Lieutenant Atwater, was occupying the light-house, it seemed desirable to know the force of the enemy.

I obtained permission to investigate this matter, and again went close in shore, driving back the squad of Spaniards which had put in an appearance at the port, and, accompanied by Naval Cadet Austin Kautz, U. S. N., and an enlisted man as interpreter, both of whom volunteered for the duty, went on shore.

We "borrowed" three fairly good horses, and went up the road to the City of Fajardo far enough to get a very good idea of the force of the Spaniards. Returning, I communicated this information, and the force at the light-house was doubled.

The Cincinnati and a collier had come in to the anchorage near the light-house, and the Leyden was moved out near them, so that the four vessels commanded the neck of land leading to the point the Amphitrite's men were holding. About midnight the Spaniards attacked them, and the Maxim-Nordenfeldt proved to be of more value than a four-inch would have been. None of the Americans were hurt, but we learned later that several Spaniards had been killed.

At daylight the Leyden steamed slowly along the beach, and took on board sixty-seven refugees, members of prominent families in that neighborhood, who had sought protection at the light-house.

With these she went to Ponce, and turned them over to the Army authorities, for there were not accommodations on the Leyden sufficient to keep this large party long.

That trip was one long to be remembered. About fifty of the refugees were women and children; the boat was small, and the sea rough, in fact, very rough. It required several days to entirely remove the traces of that short trip.

At this time hostilities had ceased, and, after a week of hard work assisting in pulling transports off the beach, transporting anchors, etc., etc., we received information which caused us to borrow bunting and construct a homeward bound pennant.

This we were allowed to use, and the Leyden had a safe and comfortable trip to Newport, R. I., where she was placed out of commission on September 5, 1898. In nearest round numbers I had finished a cruise of twenty-three thousand miles in five months, and had lost much rest, so that a few days of quiet were greatly appreciated. Until the middle of July I was the only officer attached to the vessel upon which I served, but at that time an ensign and three naval cadets, all Naval Academy men, were ordered to the Leyden. They were Ensign M. St. C. Ellis, Naval Cadets Austin Kautz, S. W. Bryant and J. C. Kress, and their abilities greatly lessened my work.

Later a paymaster was ordered to the Leyden, Assistant Paymaster W. H. Bell, and this relieved a long-felt want, for we had been for many weeks so far from our accounts that cash was an unknown quantity.

Among the unfortunate personal inconveniences suffered through the war, and as a climax to them, was the loss of nearly my entire outfit of uniforms and clothing, and in such a manner that I cannot be reimbursed by the Government.

I have been unkindly accused of stealing guns, ammunition, fenders, lumber, etc., but I am quite safe in asserting that I stole nothing. I borrowed some few things for Government use, and such as were not legitimately expended are now in possession of U. S. Naval Officers and may be found at Newport, R. I., at the Torpedo Station, if they have not been removed elsewhere since September last.

And now, with complete faith that we shall have no more wars within the next few years, my final request is that, if we do fight, I may be allowed to fit out and command the U. S. Tug Leyden.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

BATTLES AND CAPITULATION OF SANTIAGO DE CUBA.

(*Completed.*)

By Lieutenant José Müller y Tejeiro.
Second in Command of Naval Forces of the Province of Santiago de Cuba.

Translated from the Spanish.

INTRODUCTORY.

The publication by this office of the partial translation of "Battles and Capitulation of Santiago de Cuba," by Lieutenant Müller y Tejeiro, was received with so much interest both in and out of the service that the small edition of 1,000 copies was soon exhausted. The chapters there omitted were:

I. Some Historical Antecedents.
II. The United States and the Maine.
III. The First Shots.
IV. The Scene of Events.
V. Forces of the Jurisdiction (Santiago).
VI. Works of Defense.
VII. Artillery Set Up.
VIII. The Cruiser Reina Mercedes.
XIV. The Volunteers.
XXX. Escario's Column (being a description of General Escario's march across the country from Manzanillo to Santiago).
XXXIII. Suspension of Hostilities.
XXXVII. Traders, not the Spanish People (responsible for the Cuban trouble).
XXXVIII. Gerona and Santiago de Cuba (comparison of the two battles).

These have since been translated, and are given in this edition, excepting Chapters I, II, and III, which are again omitted, as they contain no original or new matter, and have no connection with the subject of the book.

Among the newly translated chapters, the one giving the diary of General Escario's march, with 3,752 men, from Manzanillo to Santiago, a distance of 52 leagues through the enemy's country, is one of great interest. Considering the nature of the country, which forced them generally to march single file, the heavy rains, and the continual harassment by the Cubans, the effectiveness of which is shown by the large number of killed and wounded on both sides, it may be classed as one of the most noticeable military feats of the war. It shows what the Cubans did toward the fall of Santiago, and a study of the situation will be interesting, considering what would have been the temporary effect if Escario's march had been unopposed, and he had arrived at Santiago with his force unimpaired a day or two before that critical period—July 2—just previous to the departure and destruction of Cervera's fleet.

RICHARDSON CLOVER,
Chief Intelligence Officer.

December 31, 1898.

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PREFACE.

On the 18th of May, the first hostile ships were sighted from the Morro of Santiago de Cuba and the first gunshots were heard, which since that date, for the space of two months, have hardly ceased for a single day.

On the following day, the 19th, the Spanish fleet, commanded by Rear Admiral Cervera, entered with very little coal, which it was absolutely necessary to replenish.

It did not require great power of penetration to understand that, owing to the scant resources available at this harbor, it would take more days to get the necessary fuel on board than it would take Admiral Sampson, Commander of the United States fleet, to find out that circumstance, and that consequently the Spanish fleet would be blockaded, as indeed it was; and as a natural and logical inference, that the enemy's objective would be the city and harbor of Santiago, where the only battle-ships that Spain had in the Antilles, or at least in the Greater Antilla, had taken refuge.

Thus, the arrival of the fleet gave this city a military importance which without that event it would never have acquired, and changed it to the principal—not to say, the only—scene of operations in the island, the dénouement of which would necessarily be of great interest and of powerful influence on the result of the campaign and the war. Subsequent events have shown the truth of my assumption, which was also the assumption of everybody else in the city.

From that time on, I have kept an exact diary, from day to day, from hour to hour, from minute to minute even—and when I say this I am not exaggerating, for it is still in existence and may be seen—of everything I saw, or that came to my notice, or that passed through my hands in my official capacity, or that I knew to be accurate and trustworthy.

When some official duty prevented me, I was ably replaced by my friend, Mr. Dario Laguna, aid of the captaincy of the port (ayudante de la capitanía de puerto), who gladly rendered the service I asked of him, in spite of his constant and manifold obligations.

If truth is a merit, these "Notes" (begging pardon for my want of modesty) possess it, though it may be their only merit.

Whatever they contain has actually happened, and those who have returned from Santiago will testify to it. Not a single fact, no matter how insignificant, herein related, is doubtful or hypothetical. Wherever I did not know the outcome of any event, or where its objects or consequences have remained a mystery, I have openly acknowledged it, without circumlocution, as any one may see who reads these notes. There is in them nothing of my own invention, and my imagination has had nothing to do with them, unfortunately, for I do not possess the gift of invention, which I admire so much in others. My work has been confined to gathering data and obtaining as much information as possible, my only care having been to see that everything was correct, and I have made sure of this by comparing the data collected with the information obtained.

Feeling sure that the events which have taken place from May 18 to July 17—hence the true situation in which were Santiago de Cuba and the forces defending it—can not be known in Spain in detail, but only in general, I am desirous of making them known in their whole truth, so that the country, to whom I think that we who were intrusted with defending its honor and interests at a distance of fifteen hundred leagues, owe the strictest account, may be able, with a complete knowledge of the facts, to call us to account, if it thinks that we have incurred any responsibility.

Such has been my object, and I trust that my comrades of Santiago de Cuba, both in the Army and in the Navy, will approve of it.

Santiago de Cuba, *August 10, 1898.*

IV.—The Scene of Events.

In order to be able to form at least an approximate idea of the events which are taking place here, and of which no one knows as yet when and how they will end, it is indispensable to know the location of the places where they are occurring, and for that reason I will describe them as briefly as possible, referring the reader to the sketch at the end of this book and the explanations concerning the different places.

Santiago de Cuba, the capital of the province of the same name, occupying the eastern part of the island, contained at the beginning of the present insurrection about 45,000 inhabitants; but the population has been reduced to about three-fourths of that, owing to emigrations and epidemics. The city is built on very hilly ground, at the head of a bay which is almost entirely closed in and very safe, so that, when seen from the city, it looks more like a lake than an arm of the sea. The distance to the mouth of the harbor in a straight line is about 4 miles.

This mouth, which is extremely narrow, is bounded on the east by the heights of the Morro and on the west by those of the Socapa, both of which are very steep toward the south, that is, where they border on the sea.

At Punta Morrillo, the western extremity of the Morro heights, which latter rise about 65 meters above the level of the sea, is situated Morro Castle, which was at one time a very good fort, well built, but in these days of modern artillery, it is not only useless, but even dangerous on account of the target which it presents, and this was the opinion of the junta of defense when they decided that whatever artillery was to be installed there should be erected on the plateau of the Morro and not inside of the castle. On this plateau are also situated the houses of the governor, the adjutant of the fort, the engineers and gunners, the lookout and the light-house keepers, also the light-house itself, which is a white light, fixed, flashing every two minutes, and visible 16 miles. Since May 18, in consequence of the events of that day, it has not been lighted.

The heights of the Socapa, whose elevation is about the same as that of the Morro heights, are bounded on the west, as already stated, by the mouth of the harbor, and contain no fortification nor defense of any kind.

Ships wanting to enter Santiago harbor must follow the Morro shore, which is bold and comparatively clear, while on the Socapa shore is Diamante Bank, consisting of rocks, leaving a channel whose depth varies between 6 and 11 meters. Between the place where Diamante buoy is anchored (in 30 feet of water) and Estrella Cove the channel is not over 50 fathoms wide. At the head of this cove, which only small boats can enter, is the hut of the English cable.

The course to be taken in order to enter the harbor is NE. 5° N. (V.) (true), until coming close to Estrella battery, an old fort which, like the Morro, was good in its time, but is now useless. From this point to Punta Soldado, which is on the eastern shore of the bay and which, with Punta Churruca, forms the entrance of Nispero Bay, the course is north, leaving to starboard Santa Catalina battery, which is abandoned and in ruins.

From Punta Soldado the course is NNW. until coming close to Cay Smith, which is to be left to port; from there the course must be shaped so as to avoid the Punta Gorda Bank, whose beacon, marking 18 feet, is to be left to starboard.

Cay Smith is a small island, or rather a large rock of small surface and great elevation, on the top of which is a small stone hermitage of modern construction; on its southern slope are 111 houses and cottages belonging to pilots, fishermen, and private citizens, who have built them for the purpose of spending the hottest season there. In the northern part there are no buildings whatever, the ground being inaccessible.

After passing Punta Gorda, the course is to be shaped for Punta Jutias, leaving to port Colorado Shoals, containing a beacon, and Cay Ratones. The latter is a small low island devoid of all vegetation. In the extreme north is a powder magazine, and in the south the guardroom of the same.

From Punta Jutias, the course is NNE. until reaching the general anchoring place, which is 8 meters deep (oozy bottom).

Santiago de Cuba has, besides many minor piers for boats and small craft, the Royal Pier and the piers of Luz and San José, all built of wood; only ships of less than 14 feet draft can go alongside of these. Between the city and Punta Jutias, at a place called Las Cruces, is the pier of the same name, built of iron with stone abutments, belonging to the American company of the Juragua iron mines; it has a watering place, the water coming from Aguadores in pipes. Ships of large draft can go alongside of this pier. A narrow-gauge railroad from the mines, passing over 26 kilometres of ground, goes to the extreme end of the pier.

Santiago is an open city, with not a vestige of fortification in its precinct (I am speaking of the beginning of the present war), and only at Punta Blanca, situated just south of it, is a battery of the same name, with a small powder magazine, intended only for saluting purposes and to answer salutes of warships casting anchor in the harbor.

From the above it will be seen that the mouth of Santiago harbor is defended by nature in such a manner that nothing is easier than to render it truly impregnable in a short time by installing modern artillery in batteries erected where it would be most necessary and convenient. The heights of the Morro and Socapa have a full view of the sea, and being difficult of access by land, they are easy to defend. Punta Gorda, owing to its admirable location and being high above the level of the sea, has entire control of the channel, and any ship trying to enter would necessarily be exposed to its fire and present her bow and port for at least twenty minutes. The very narrow entrance is well adapted for laying lines of torpedoes which could be easily protected by rapid-fire artillery erected on the western shore, preventing them from being dragged or blown up. Moreover, no matter how large a fleet might attempt to force the harbor, as but one vessel can pass through the channel at a time, and that only with the greatest care and precautions if it is over 80 meters long, nothing is easier than to sink it; and in that event, the channel would be completely obstructed and the harbor closed, until the submerged vessel is blown up.

It is evident, and almost superfluous for me to mention it, that with the same ease that a fleet trying to force the harbor can be prevented from entering, another fleet can be prevented from leaving it. But since Spain, in spite of all that was being done in the United States, never for a moment believed that war would come, it has not occurred to her to fortify this harbor. There were no guns; but on the other hand, plenty of good plans and designs which the military authorities in Santiago have never been able to have carried into effect, for the simple reason that the Government never got around to ordering that it be done.

Three miles west of the entrance of the Morro is the small harbor of Cabañas, which, while accessible only for small vessels, is very safe and well suited for landing purposes. It has 6 feet of water at the bar and 5 fathoms inside. The distance by land from Cabañas to Cabañitas on Santiago Bay is about a league.

Six miles farther west, or 9 miles from Santiago, is Punta Cabrera, the headland extending farthest south and the last one which can be seen. It is a high cone-shaped mountain. As the coast is very accessible, vessels of great draft can approach it. At the small cove of Guaicabon, east of said point, boats can land and communicate with the shore, which, in fact, is being done at this time by a steam yacht of the American fleet, which is probably receiving confidential information from the insurgents. Guaicabon is about 2 leagues from Santiago by land and the road is good.

Three miles east of the Morro is Aguadores Bay; it is crossed by a high bridge, over which passes the railroad of the Juragua mines. Boats can enter the river which empties into this bay; it is an excellent place for landing.

A quarter of a mile farther east is the roadstead of Sardinero, with a river emptying into it.

Three-fourths of a mile from there is Jutici, a small roadstead with a watering place.

Ten miles farther on is Juragua Beach, with a river that boats can enter.

Fifteen miles from there is Daiquiri Bay, with a river and watering places. Boats can enter here. Daiquiri Bay has a very fine stone and iron pier, also a small one for minor craft. Ashore, a short distance from the pier, are the offices of the employees of the mines and railroad for the transportation of the mineral from the mines to the pier, about 6 miles long. Large vessels can go alongside the iron pier.

Finally, 20 miles farther east is Punta Berracos, the last point which can be distinguished from the Morro, and the one projecting farthest south. Although it is possible to land here, with a great deal of work, it is not advisable to do so, there being no watering place and no road.

In all these places, east as well as west of Santiago, vessels can not remain with strong south or southeast winds, but must necessarily put to sea.

Aguadores and Santiago are connected by the Juragua railroad. The road along the coast is bad; it is a little over a league long.

From Sardinero to Santiago there are 2 leagues of good road.

The road leading from Juraguacito to Santiago is the Guásimas road, which is good, beginning at El Caney. It is 4 leagues long.

From Juragua to Santiago is the Sevilla road, which also leads to El Caney. This road and the former meet at a place called Dos Caminos. It is a good road, and about 4 leagues long. Moreover, as has been stated, there is a narrow-gauge railroad from the mines, which passes through Aguadores and terminates at Las Cruces Pier.

At Berracos there are no roads whatever, only paths, over which it is not possible to transport artillery.

The railroad to San Luis, 32,460 meters long, starts from Santiago and passes through the following points: Santiago, Cuavitas (station), Boniato, San Vicente, Dos Bocas (station), Cristo, Moron, Dos Caminos, and San Luis.

From Cristo a branch line of 10,300 meters goes to Songo. Trains are now running as far as Socorro.

These are the different places which form the scene of events now claiming the attention of the island of Cuba, and probably also of the Peninsula; and these events, whatever may be their outcome, will be of great importance and powerful influence on the result of the war.

V.—Forces of the Jurisdiction.

The present insurrection broke out on February 24, 1895, in the eastern provinces, but it soon invaded the western provinces and spread over the whole island from Cape San Antonio to Cape Maysi.

In order to check it, or at least reduce it to narrower limits, General Weyler conceived and carried out the plan of moving his forces from west to east, building trochas to prevent the insurgents from again invading the pacified provinces, or to inclose them between two lines of soldiers more or less difficult to force.

Consequently the greater part of the forces of the army of Cuba occupied the provinces of Pinar del Rio, Havana, Matanzas, and Las Villas, for the purpose of carrying on active operations there, leaving a very small number at Camaguey, and still less in the eastern provinces. These latter provinces, therefore, could do nothing more than defend the country and the cities and towns and prevent the enemy from entering them. Hence, when the war with the United States broke out, the division of Santiago, consisting of two brigades, had to cover the districts of Santiago, Guantánamo, Baracoa, and Sagua; and it is only necessary to cast a glance at the map in order to understand how difficult it would be to control such an immense territory with such scant forces, which had to garrison many cities, towns, forts, and redoubts, cover four railway lines (from Santiago to Sabanillo and Maroto, to Juragua, to Daiquiri, and from Caimanera to Guantánamo), act as convoys, protect the mineral regions, and provide also for the formation of more or less numerous flying columns to harass the enemy incessantly. Fortunately this division was in command of General Linares, whose energy and zeal can never be sufficiently praised, and whose well-deserved promotion to lieutenant general was learned here by cable about the middle of May.

As the events which I propose to relate are only those directly concerning Santiago de Cuba and its jurisdiction, where they have taken place and which I have had a chance to witness, they will be the only ones that I shall refer to.

The first brigade of the division consisted of the following forces:

Chief of division, Lieut. Gen. Arsenio Linares Pombo;

Chief of staff, Lieut. Col. Ventura Fontán;

Military governor of Santiago and chief of the forces of that division, General of Division José Toral;

Chief of staff, Luis Irlés;

Chief of the San Luis brigade, General of Brigade Joaquín Vara del Rey;

Chief of staff, Captain Juan Ramos.

It will be seen from the above that the brigade was really divided into two divisions, one under the orders of General Toral, and the other under the orders of General Vara del Rey. The forces composing both divisions were as follows:

Twelve companies of mobilized troops;

Two squads of the regiment of royal cavalry (less than 200 horse);

Two battalions of the regiment of Santiago infantry;

One Asiatic battalion;

One provincial battalion of Puerto Rico, No. 1;

One battalion of San Fernando;

One battalion "Constitucion;"

Also half a battery of artillery and a small force of the civil guard and engineers.

To these forces must be added the battalion of Talavera, which General Linares ordered from Baracoa as soon as the present war was declared and in anticipation of coming events.

These forces form at most a total of 8,000 men.

General of Brigade Antero Rubín was under orders of General Linares.

Florencio Caula, colonel of the senior corps, was commander of engineers of the city, and Lieut. Col. Luis Melgar commander of artillery; the latter turned his command over to Colonel Ordóñez on April 29 upon being appointed superintendent of the artillery park.

Administrative chief, First-class Commissary Julio Cuevas.

Chief of the civil guard, Col. Francisco Oliveros.

Superintendent of the military hospital, Sub-inspector Pedro Martín García.

Governor of Morro Castle, Commander of Infantry Antonio Ros.

When the first insurrection broke out in the Island of Cuba in 1868, bodies of volunteers were formed which have rendered good services as garrisons of the fortified places. At Santiago, according to official statements, there were the following:

	Men.
First battalion: Col. Manuel Barrueco	630
Second battalion: Lieut. Col. José Marimón	485
Firemen: Col. Emilio Aguerrizábal	324
Company of guides: Capt. Federico Bosch	200
Company of veterans: Capt. José Prat	130
Squad of cavalry	100
Total	1869

Santiago de Cuba is the capital of the maritime comandancia of the same name, bounded on the south by Junco Creek and on the north by Sagua de Tánamo, and divided into four districts: Manzanillo, Santiago de Cuba, Guantánamo, and Baracoa. The commander of this maritime comandancia was Capt. Pelayo Pedemonte, of the navy.

The prelate of the archdiocese Ilmo was Francisco Sáenz de Urturi.

Governor of the province, Leonardo Ros.

President of the audencia territorial, Rafael Nacarino Brabo.

Mayor, Gabriel Ferrer.

The consular corps was represented by the following gentlemen:

Frederick W. Ramsden, England;

Germán Michaelsen, Germany, Austria-Hungary, Belgium, Italy;

E. Hippean, France;

Pablo Bory, Mexico;

Juan E. Rabelo, Santo Domingo;

Temístocles Rabelo, Paraguay;
Juan Rey, Hayti.

The vice-consuls were:

Jacobo Bravo, United States of Colombia;
Isidoro Agustini, Sweden and Norway;
Leonardo Ros, Netherlands;
Modesto Ros, Portugal;
Eduardo Miranda, Venezuela;
Robert Mason, China;
José J. Hernández, Argentine Republic.

The United States consul left on April 7 in an English steamer bound for Jamaica, having turned over the archives of his consulate to the British consul.

VI.—Works of Defense.

The governments of Spain have thought more than once of fortifying the coasts of the Island of Cuba, and for that purpose committees have been appointed who have studied the matter and submitted many good, even excellent, plans, which have been approved, but never carried into effect.

There was at Santiago a junta of land and marine defenses of the city, composed of the following persons:

President, the military governor of the city, General of Division José Toral; voting members, the commander of marine, Capt. Pelayo Pedemonte; the commander of engineers of the city, Col. Florencio Caula; the commander of artillery of the city, Lieut. Col. Luis Melgar; and the chief of submarine defenses, First Lieut. José Müller, of the navy.

The latter officer, whose regular office was that of second commander of marine, was only temporarily chief of submarine defenses, in the absence of torpedo officers, he not being one.

This junta held meetings whenever it was deemed necessary, until April 8, when a cablegram from the captain general of the island ordered that it become permanent, and that the commander of marine give his opinion as to the suitability of laying torpedoes. The junta, taking into account the grave situation, the imminence of war, and the scarcity of artillery material and appliances and resources of any kind, expressed the unanimous opinion that the only defense that could be counted on for the harbor were the torpedoes, for which the material was at hand, and consequently that they should be given preference, and everything within human power done to protect them and prevent their being dragged or blown up; in a word, that the torpedoes should be placed as the only veritable defense and everything else subordinated to them.

As early as the second day of the same month (April) the commander of submarine defenses, in compliance with orders received, had already commenced to charge the Latiner-Clark torpedoes, transferring them to Cay Ratones, where the powder magazine was located that contained the gun-cotton, also to place the buoys for the first row of torpedoes, and to carry out other operations in connection therewith.

The junta of defense, in view of the poor condition of Morro Castle and Estrella and Catalina batteries and of the information which the American consul would probably give his Government, decided to remove the torpedo-firing and converging stations from said forts where they were and erect them at places on the bay where they would be protected and sheltered from the hostile fire, and this was done.

On April 14 the second commander of marine turned over the submarine defenses to a torpedo officer, Lieut. Mauricio Arauco, commander of the gunboat Alvarado, who continued the work of laying the torpedoes; the first row, consisting of seven, with their firing stations at the Estrella and Socapa, was finished by April 21, and the second row, consisting of six, with stations at the Socapa and Cay Smith, on the 27th.

By orders of the commander general of marine (Havana), the second commander of marine of the province, together with Colonel of Engineers Angel Rosell and Captain of Artillery Ballenilla, left for Guantánamo on April 21, for the purpose of selecting the most suitable site for planting Bustamente torpedoes in that harbor so as to prevent ships from reaching Caimanera, returning to Santiago on the 25th after finishing the investigation. The torpedoes were subsequently placed by First Lieut. Julián García Durán at the site selected.

On the 23d, the gunboat Sandoval left for Guantánamo, where her crew was to plant the Bustamente torpedoes. She has since remained at that harbor.

Two days before, on the 21st, orders were received from

Havana to remove from the interior of the harbor all light buoys and beacons, which orders were promptly complied with.

It was also agreed by the junta of defense to establish at Punta Gorda a battery composed of two 15-cm. Mata howitzers and two 9-cm. Krupp guns, and the corps of engineers at once proceeded to clear the plateau of the mountain, build the road, and do other work preparatory to erecting such a battery. By the 26th, the two howitzers were ready to fire, and the two guns by the 27th, all of them being breech-loaders. This battery, which, as will be seen later, had two 16-cm. Hontoria guns, is the best of all the batteries erected, because it was done with less haste, and perhaps also because the ground was particularly well adapted. It was placed in command of Captain of Artillery Seijas, who had previously had command of the Morro battery.

On April 18 there arrived from Havana three 21-cm. muzzle-loading howitzers, and a few days later, in the steamer Reina de los Angeles, three more from the same city.

A cablegram from Havana stated that, according to information received, the steamer Margrave would try to cut the cable at Santiago, thereby cutting off our communications, and it was therefore ordered to erect on the esplanade of the Morro two old 16-cm. guns, more for the purpose of making signals than to attack the enemy. They were both taken up there; one of them was mounted on a wooden carriage and the other was not mounted.

On April 21, two short 8-cm. Plasencia guns (breech-loading) were mounted at Estrella Cove.

At the Estrella battery there had been installed some time ago an old 21-cm. rifled howitzer, and another partly installed. In view of the unfavorable location of the battery, it was decided to abandon both; but after the 28th, the second was mounted, also the two Plasencia guns that had previously been erected at Estrella Cove, together with two short 12-cm. rifled bronze guns. Not a single one of these pieces was fired. The battery was in command of Lieutenant of Artillery Sánchez of the reserve forces; he was subsequently assigned to the artillery of the precinct.

By May 28, five 16-cm. rifled muzzle-loading bronze guns had been mounted on the esplanade of the Morro.

On June 21, a 21-cm. muzzle-loading howitzer was erected at the same place, and another on the 25th.

On the high battery of the Socapa were mounted: on June 13, a 21-cm. muzzle-loading howitzer; another on the 16th; another on the 17th.

RÉSUMÉ.

Punta Gorda battery, in command of Captain of Artillery Seijas:

Two 15-cm. Mata howitzers;

Two 9-cm. breech-loading Krupp guns.

Estrella battery, in command of Lieutenant Sánchez:

Two 21-cm. old howitzers;

Two 8-cm. modern Plasencia guns;

Two short 12-cm. rifled bronze guns (old).

None of these were fired.

Morro battery, first in command of Captain Seijas, later of Lieutenant León:

Five old 16-cm. guns;

Two old 21-cm. guns.

High battery of the Socapa:

Three old 21-cm. howitzers.

It will be seen that this whole artillery includes only six breech-loading guns, four erected at Punta Gorda and two Plasencia guns at Estrella, which latter two, owing to the location of said battery, could not be fired. All the others were old guns, and it is well known that it takes a long time to load them and that their fire is very uncertain.

The dates when these different guns were erected and ready to fire should be kept in mind, so as to know which could answer hostile attacks and which not on the different days when the enemy bombarded the mouth of the harbor and the bay.

VII.—ARTILLERY SET UP.

It will be sufficient to remember what has been said in the preceding chapter to understand that, in spite of the fact that Santiago has a harbor which is so easy to defend and the possession of which it was so imperative to maintain, in spite of its being the capital of the eastern half of the island and at such a long distance from Havana, there were at Santiago at the time the present war broke out not more than six modern breech-loading guns, namely, two 15 cm. Mata howitzers, two 9-cm. Krupp guns, and two 8-cm. Plasencia guns. That was all the artillery worthy of the name, and even these guns, owing to their small calibers, were useless, or almost so, against armorclads and cruisers.

The others, as has been seen, were old bronze and even iron muzzle-loaders which could not fire more than one shot to every twenty fired from one of the enemy's guns, and all they sent us from Havana were six 21-cm. howitzers, likewise old muzzle-loaders, this being all the material received here to oppose a powerful modern fleet. These facts might appear exaggerated if there were not others that appear still more so, but which are shown in official statements and statistics of forces available, and these can not be doubted. For the service of all the guns, including those set up in the precinct, there were only 79 gunners; of course, it became necessary to complete the indispensable number with soldiers of the infantry.

To mount this artillery, which was defective if not entirely useless, but which was nevertheless set up at the Morro, Punta Gorda, and the Socapa, endless difficulties had to be overcome and work done which only the intelligence, energy, and perseverance of the chiefs and officers and the subordination and good will of the soldiers could accomplish, when resources and aids of every kind were absolutely lacking.

By simply looking at the esplanade of the Morro one would realize the work it must have required to take guns up there weighing three or four thousand kilos, by a road which, I believe, has not been repaired once since the castle was first built.

To install the guns at Punta Gorda everything had to be done from building the pier, where the guns were landed, to clearing the summit of the mountain, where they were set up, and opening a zigzag road by which they were taken there.

To mount the howitzers at the Socapa was truly a piece of work worthy of Romans, and of the six received only three could be set up.

But where the corps of engineers never rested for a moment, and accomplished the most difficult work with the smallest force, was around the city in a line about 14 kilometers long.

Closer to the city three lines of defenses were built, with trenches, breastworks, inclosures, wire fences, and whatever other obstacles the configuration of the ground might suggest; the so-called forts, already in existence, were improved and new ones built; in a word, an open city, which had no fortifications of any kind to oppose to the enemy, was, in the short space of a few days, placed in condition of resistance with chances of success.

From the moment that our fleet entered Santiago harbor, it was not difficult to surmise that it would become the enemy's objective, upon which all his efforts would be concentrated, and it was for that reason, always expecting the landing which was finally effected, that the work above described was carried out, and the rest of the artillery of the city, likewise old, mounted in the following positions:

June 12—One 16-cm. rifled bronze gun, at Fort San Antonio;
One short 12-cm. rifled bronze gun at Santa Inés;
Two short 8-cm. rifled bronze guns at Fort San Antonio.

June 13—One 16-cm. rifled bronze gun, and
One short 12-cm. rifled bronze gun at the entrance to El Caney.

June 14—One 16-cm. rifled bronze gun;
One short 12-cm. rifled bronze gun, and
Two short 8-cm. rifled bronze guns at El Sueño.

June 16—One 16-cm. gun, and
Two short 8-cm. guns at Santa Ursula.

June 17—One 16-cm. rifled bronze gun at Cañadas.

June 25—One short 12-cm. rifled bronze gun at Fort Horno;
One short 12-cm. rifled bronze gun at Fort Nuevo.

After the battle of July 1 the following were mounted:

At Santa Ursula—Two long 12-cm. rifled bronze guns.

At entrance of El Caney—Two guns of same type as above.

At Santa Inés—One long 8-cm. bronze gun (old). The breech pieces of this latter gun were missing.

With General Escario's column two 8-cm. Plasencia guns arrived from Manzanillo; but, like all those mounted since July 1, they did not get a chance of being fired, the battles having ceased by that time.

Hence the only modern artillery existing in the precinct of the city, namely, one 9-cm. Hontoria, two 75-mm. Maxim, and two 8-cm. Plasencia guns, was not fired.

All the 8-cm. guns had been pronounced useless by the central junta of Havana, and, far from being effective, they were even dangerous.

The 12-cm. guns were mounted in carriages of other guns, and were therefore useless in themselves, without being disabled by the enemy.

VIII.—The Cruiser Reina Mercedes.

It does not require a deep knowledge of artillery to understand that the batteries erected at the Morro and Socapa, and even at Punta Gorda, were powerless, or almost so, against armored and protected ships. As to the Estrella battery, I even refrain from mentioning it, because owing to its location it was not fired at all. Of the only modern artillery, at Punta Gorda, the guns were of small caliber, and the howitzers, owing to their indirect fire, are very uncertain against ships which occupy comparatively very little space. As to the guns of the Morro and Socapa, when I say that they were old howitzers I think I have said enough. Having had no other artillery, it may well be supposed that we, who witnessed and sustained the blockade of Santiago, feel satisfaction and pride in being able to say that we kept the American fleet, notwithstanding its power and the number of its guns, for seventy days, namely, from May 18 to July 17, in front of the mouth of the harbor, on the sea, and at a respectable distance from our batteries, which they were unable to silence, and not daring to force the entrance.

It is only just to say, and I take pleasure in doing so, that this result is due, in the first place, to the cruiser Reina Mercedes, under the command of Captain Rafael Micón, and in the second place, to our fleet anchored in the bay, and which the enemy would have had to fight after forcing the harbor, provided they had succeeded in doing so, but they do not appear to have thought of it.

Owing to the very bad condition of the boilers of the Reina Mercedes, it was impossible for her to proceed to Havana, as most of the vessels cruising in these waters did sooner or later, and it was taken for granted that, in view of her condition, she would play but a secondary part during the events here; it did not occur to any one that the Mercedes might become, if not the salvation, yet the providence, so to speak, of Santiago harbor, and that she was to be of such great assistance to the heroic defense made by the batteries.

Her crew had been considerably reduced by detachments and sickness, but it was well disciplined and enthusiastic, and commanded by chiefs and officers as intelligent as they were energetic and indefatigable. The vessel cast anchor at the Socapa on March 23 and proceeded to send down her yards and topmasts and protect her starboard side (the one she presented to the mouth of the harbor) with her light cables, thereby protecting the torpedo magazine as much as possible from the hostile fire.

On the 26th, in obedience to superior orders, she had to undo everything that had been done and again anchor in the bay, returning to the Socapa a few days later, when she went to work once more sending down the masts, protecting her side, etc.

At the same time one of her steam launches, with a crew from the Mercedes, rendered service at the comandancia de marina, where she became indispensable, and the other steam launch and the boats assisted in laying the torpedoes, towing launches, and did a thousand other things, some of them not properly belonging to vessels, but all equally indispensable.

On May 7 work was commenced on dismounting four of the 16-cm. Hontoria guns, under the direction of Boatswain Antonio Rodríguez Díaz, a derrick having been erected for that purpose, which removed the guns with their mounts from the vessel. The latter now had only the two bow guns left to defend the mouth of the harbor and rows of torpedoes.

All of the four guns were taken up to the Socapa by fifty sailors of the Mercedes and forty of Captain Mateu's guerrillas. One was mounted and ready to fire by the evening of the 18th, the other by the 28th, the engineers having previously finished the trenches and cement foundations for setting them up.

The third gun was mounted at Punta Gorda by a crew from the vessel by June 2, and by the 17th the fourth and last one had been mounted. These two 16-cm. Hontoria guns, erected on the western slope of Punta Gorda, were placed in charge of Ensign Vial, under the command of Captain of Artillery Seijas.

The two Hontoria guns at the Socapa were placed in charge of Ensigns Nardiz and Bruquetas respectively.

The erection of the last gun mounted at Punta Gorda was superintended by Boatswain Ricardo Rodríguez Paz, Boatswain Rodríguez who had superintended the others having been wounded.

These four guns were mounted for the purpose of directly attacking the hostile fleet.

The crew of the Mercedes, besides defending the torpedo lines and preventing the approach of small craft that might attempt to disable them, also mounted at the lower battery of the Socapa, west of the channel of the harbor, the following guns:

One 57-mm. Nordenfeldt gun;

Four 37-mm. Hotchkiss revolving guns;

One 25-mm. Nordenfeldt machine gun.

The latter belonged to the submarine defenses, the others to the Mercedes. Lieutenant Camino was placed in command of this battery.

It seems almost superfluous to state that all the artillery from the Mercedes set up ashore was served by men and commanded by officers from the crew of the vessel and that the same difficulties were encountered in this work as in the land defenses, there being the same obstacles and the same lack of resources and appliances; moreover, two of the torpedo firing stations were manned by officers from the Mercedes; they actually seemed to multiply themselves to be able to render all these services. Words fail me to do justice to the officers and men for the work accomplished, especially while the guns were being mounted in the batteries.

Although it may be anticipating events, I can not help but say that some ships, like some men, seem pre-ordained to be martyrs. When long afterwards the Mercedes returned to the bay, having left the anchoring place at the Socapa on account of the many casualties which she had suffered passively, if I may be permitted the expression, the American ships, by a singular coincidence, threw their projectiles at the very spot where she was at anchor, as though an invisible hand had been guiding them.

Finally, when she had nothing left her but her hull to offer in sacrifice, she went down in the channel of the harbor, in order to oppose to the very last moment, and even after death, an enemy whom she had so fiercely fought during her life-time. Peace to her remains!

IX.—The Two Fleets.

When the war between Spain and the United States became a fact, it is hard to tell how much was said and written about the

Spanish fleet, or rather, fleets; everybody knows of the thousands of items which appeared in the newspapers concerning the purchase of ships, to such an extent that, if all could have been believed, our navy would have been vastly superior to that of the United States, in number and quality. And this is so true that the least optimistic, the most reasonable people, those whom we considered best informed as belonging to the profession and who knew to a certain extent what we could expect, counted on not less than eight battle-ships leaving the Peninsula, to say nothing of the transports, torpedo-boats, destroyers, etc. How much we were mistaken!

On the 19th of May, at 5.50 o'clock A. M., the look-out signaled five steamers to the south; shortly after it was signaled that the five steamers were five warships, and a little later that they were Spanish. So the much wished-for fleet had arrived, which, according to the newspapers, was under the command of Vice Admiral Butler.

At 7.15, the Infanta Maria Teresa, hoisting the rear admiral's flag, was sighted from the captaincy of the port; a few minutes later, she cast anchor in the bay, some distance from the royal pier, her draught not permitting her to go nearer. Then the Vizcaya, Oquendo, and Cristóbal Colón anchored one after the other, the last named with the flag of the second-in-command (brigadier); then the destroyer Plutón entered, went out again without anchoring, and returned an hour later with the Furor, of the same class, and both anchored at a convenient place.

The day when the fleet entered Santiago harbor was one of those beautiful mornings that are so frequent in tropical countries; not the slightest breeze rippled the surface of the water, not the least cloud was to be seen in the deep blue sky, and still, notwithstanding all that the local papers have said, very few were the people who came down to witness the arrival of the ships. With the exception of the official element and a small number of Peninsulars, the arrival of our warships inspired no interest, nor even curiosity. And I say this and want it understood, because it is the best proof of the sympathies which the country professes for us and of which it gives us constantly unquestionable proofs whenever opportunity offers.

The fleet was under the command of the eminent Rear Admiral Pascual Cervera, who, as already stated, had hoisted his flag on the Infanta Maria Teresa, Captain Joaquin Bustamente being chief of the general staff. The second in command was Captain José de Paredes, who had hoisted his flag on the Cristóbal Colón.

The Infanta Maria Teresa, built at the Nervión shipyards, is a ship of 103.63 metres length, 19.81 beam, and 7,000 tons displacement, with a draught of 6.55 metres. Her engines develop 13,700 I. H. P., giving her a speed of 20.25 miles. Her armament consists of two 28-cm. Hontoria guns (mounted in turrets, one forward and one aft); ten 14-cm. Hontoria guns; eight 57-mm. Nordenfeldt rapid-fire guns; eight 37-mm. Hotchkiss revolving guns, and two 11-mm. machine guns. She was commanded by Captain Victor Concas.

The Vizcaya, commanded by Captain Antonio Eulate, and the Oquendo, commanded by Captain Juan B. Lagaza, are exactly like the Maria Teresa and built at the same yards.

The Cristóbal Colón, under the command of Captain Emilio Diaz Moreu, was acquired in Genoa from the firm of Ansaldo. She is 100 metres long by 18.20 beam; her displacement is 6,840 tons and her draught 7.75 metres; her speed is 20 miles and her engines develop 13,000 I. H. P. Her armament consists of two 254-mm. Armstrong guns (in turrets); ten 132-mm. guns; six 120-mm. guns; ten 57-mm. Nordenfeldt guns; ten 37-mm. and two machine guns.

Important note: The last-named ship, her 254-mm. or large calibre guns mounted in turrets not being ready, had to go without them.

The destroyer Plutón was commanded by Lieutenant Pedro Vázquez, and the Furor, of the same class, by Lieutenant Diego Carlier; both of them were under the command of Captain Fernando Villamil.

The arrival of these six ships produced real enthusiasm among the better peninsular element in Santiago, especially as nobody wanted to believe that they were the only ones that Spain was going to send, since they were called the "first division," and at least two more divisions were expected. The only ones who had no illusions, who knew what to expect, who were acquainted with the true condition of affairs, were those who had arrived in the ships. From the admiral down to the last midshipman, they knew perfectly well that there were no more fleets, no more divisions, no more vessels, and that those six ships (if the destroyers may be counted as such) were all that could be counted on to oppose the American fleet, which consists of the following ships, not including those in construction, and taking into account only armored and protected ships—that is, those of the first and second classes:

Iowa, 11,340 tons, steel, first-class battle-ship, 18 guns.

Indiana, 10,288 tons, steel, first-class battle-ship, 16 guns.

Massachusetts, 10,288 tons, steel, first-class battle-ship, 16 guns.

Oregon, 10,288 tons, steel, first-class battle-ship, 16 guns.

Brooklyn, 9,215 tons, steel, first-class protected cruiser, 20 guns.

New York, 9,200 tons, steel, first-class protected cruiser, 18 guns.

Columbia, 7,375 tons, steel, steel, first-class protected cruiser, 11 guns.

Minneapolis, 7,375 tons, steel, first-class protected cruiser, 11 guns.

Texas, 6,315 tons, steel, first-class protected cruiser, 8 guns.

Puritan, 6,060 tons, steel, first-class protected cruiser, 10 guns.

Olympia, 5,870 tons, steel, first-class protected cruiser, 14 guns.

Chicago, 4,500 tons, steel, second-class protected cruiser, 18 guns.

Baltimore, 4,413 tons, steel, second-class protected cruiser, 10 guns.

Philadelphia, 4,324 tons, steel, second-class protected cruiser, 12 guns.

Monterey, 4,084 tons, steel, second-class protected cruiser (with turrets), 4 guns.

Newark, 4,098 tons, steel, second-class protected cruiser, 12 guns.

San Francisco, 4,098 tons, steel, second-class protected cruiser, 12 guns.

Charleston, 3,730 tons, steel, second-class protected cruiser, 8 guns.

Miantonomoh, 3,990 tons, iron, monitor, 4 guns.

Amphitrite, 3,990 tons, iron, monitor, 6 guns.

Monadnock, 3,990 tons, iron, monitor, 6 guns.

Terror, 3,990 tons, iron, monitor, 4 guns.

Cincinnati, 3,213 tons, iron, second-class protected cruiser, 11 guns.

Raleigh, 3,213 tons, iron, second-class protected cruiser, 11 guns.

Note: Before war was declared, they bought of Brazil the Amazonas, a magnificent protected cruiser of more than 6,000 tons, with perfect armament. She was one of the ships that blockaded this port.

It is to be noted that in the first eleven ships enumerated, the number of guns stated is only that of the large-calibre guns, that is, from 16-cm. upward, without including rapid-fire, revolving, machine guns, etc.

The first four, namely, the Iowa, Indiana, Massachusetts, and Oregon, have four 32-cm. guns each, that is to say, larger guns than the medium-calibre ones of the Maria Teresa, Oquendo, and Viscaya, each of which had but two 28-cm. guns. The Cristóbal Colón, as has already been stated, did not have her large guns mounted.

Shortly after the fleet had anchored, the civil and military authorities went on board to pay their respects to Admiral Cervera.

It will be remembered that these ships had been assembled at the Cape Verde Islands and that many notes were exchanged on that subject between the Governments of Spain and the United States, until finally the Spanish Government gave definite orders for the ships to proceed to the Island of Cuba.

They arrived at Martinique, where they left the destroyer Terror, commanded by Lieut. Francisco de la Rocha, for the reason that the vessel had sustained injuries to her boiler and was no longer able to follow the fleet. From Martinique, the ships proceeded to Curaçao, where only two ships could take a small quantity of coal, as the laws of that Dutch colony did not allow any more to enter the harbor. Finally, as stated above, the fleet reached this harbor, without having met Admiral Sampson's fleet, whether accidentally, or whether Admiral Cervera went by way of Curaçao on purpose to mislead the American admiral, I do not know.

X.—Provisions of the City.

So far my task has been, if not easy, at least pleasant, for in honor of the truth and deference to justice, I will say that all persons who have so figured, directly or indirectly, in the events under discussion, deserve praise and congratulations. Unfortunately, I can not say as much regarding the question of provisions, which is of such great importance, and has had so much to do with the capitulation of this city.

It is far from me to want to mention or censure any person or persons in particular. I am citing facts which every one knows, and I believe it to be a duty which I must not shun to set forth everything with perfect impartiality. I am making history, and with that I have said everything.

The city of Santiago de Cuba has never been very well supplied and provisions have never been abundant there.

It is only just to state that the whole military element of the province and also the hospitals were nine or ten months in arrears in the payment of consignments. They had been living on credit for some time, and the firms furnishing the supplies, not being able to order new ones and meet their obligations, had allowed their stores to run very low. We were passing through one of those crises which were so frequent in our last war, and which, unfortunately, are being repeated in this, owing to the parsimony of the Treasury.

But now, under the circumstances in which Santiago de Cuba was, the problem assumed more serious shape, for living became almost impossible. Everything was lacking: articles of food, prospects, money; our credit and purchasing resources were exhausted. And this was the case not only at the capital, but extended to the whole division. What happened at Santiago, also happened at Manzanillo, Holguin, Puerto Príncipe, Ciego de Avila, Morón, Spíritus, and other places of the island, namely, the cities supplied the people of the surrounding country and the latter had no provisions or stores to furnish in return.

Moreover, the merchants of this city, little given to great enterprises and risky speculations, did not have on hand any more than what they felt sure they could sell in a short time. And, therefore, I repeat it, provisions, even those of first necessity, were certainly not abundant, and everybody knew that when the hostile ships should arrive to blockade the city, as must happen sooner or later, these would soon give out. A few families understood it and laid in supplies in anticipation of what was to come, and they certainly did not regret it, for their fears were realized, although, be it said in honor of the truth, there was no motive or reason to justify such a condition of affairs.

War was officially declared on April 21, and until the 18th of May not a single hostile ship appeared in sight of the harbor. There were in it five Spanish merchant vessels, which were prevented from leaving by the breaking out of hostilities, the Méjico, Mortera, San Juan, Reina de los Angeles, and Tomas Brooks. Jamaica is only 80 miles from Santiago, and yet not a single sack of flour entered the city since before the 21st of April, when a small English sailing schooner came from there with a cargo of butter, potatoes, onions, and corn-meal, which she sold for a good price without landing it at the custom-house. The example was not followed; everybody saw the possibility of the conflict which had to come without trying to prevent it.

Had it not been for the arrival of the German steamer Polaria, which, fortunately, left at Santiago 1,700 sacks of rice intended for Havana, there would have been an absolute lack of provisions, as neither the merchants nor any one else attempted to import them.

The last provisions entering the trading houses were brought by the steamer Mortera on the 25th of April, consisting of 150 head of cattle, 180,000 rations of flour, 149,000 of peas, 197,000 of rice, 79,000 of beans, and 96,000 of wine. Now, without including the forces of Guantánamo, Baracoa, and Sagua de Tánamo, the needs of the troops of Santiago de Cuba amounted to 360,000 rations a month. Thus it will be seen that the provisions on hand in the trading houses the last days of April were hardly sufficient for half a month.

And this is not the worst; but the merchants, far from contributing to the welfare of the army, which in reality was defending their interests, hid whatever they could and raised the prices in a manner which I do not wish to qualify, taking advantage of the sad stress to which the blockade had reduced the city.

An example will show this better than anything I may say on the subject. The man who had the contract of furnishing water at the bay, relying on the letter of his contract, tried to charge the ships of the fleet for the water which they were getting at Las Cruces pier, this water being the property of the American company of the Juragua mines, for which the Spanish Government could therefore not contract, and was conveyed on board by means of the water pipes, which are there for that purpose, the pump being kept going night and day by the soldiers of Colonel

Borry's column. Nearly all the ships took over 500 pipes of water each, which, at 4 pesetas a pipe, amounts to several thousand dollars. The contractor in question, whose name I do not wish to remember, is from the Peninsula, a captain of volunteers, and, as he says himself, "a better Spaniard than Pelayo."

I do not know what news may have reached the Peninsula about the conditions at Santiago de Cuba. It is possible that people believe there that only certain articles of food were lacking; if that is the case, they are greatly mistaken. People here have suffered from actual hunger, and many persons have starved to death, although the population has been greatly decreased, since whole families had left prior to the 21st day of April. I, myself, saw a man who had died of hunger in the entrance of the Brooks House opposite the captaincy of the port—died because he had nothing to eat.

Horses, dogs, and other animals were dying from hunger in the streets and public places and the worst thing was that their carcasses were not removed. I also saw—this is significant on account of the fatal consequences that might follow—I saw, I repeat, a dog throw himself upon a smaller one and kill and devour him. The water from the aqueduct had been cut off, as will be seen, and the city was exposed to the danger of the dogs going mad, and we should have had that calamity to add to the many that were weighing upon us. But why go on? What I have said is more than sufficient to show the immense responsibility incurred by those who might have supplied the city with provisions, and who neglected and eluded so sacred a duty.

There were orders and decrees published regulating the price of articles of first necessity, but the merchants paid no attention to them, as though they did not concern them, and the raising of prices was the more unjustifiable and inexcusable, as everything that was in the city had been there prior to the declaration of war, and had cost no more freight or duty than in normal times.

If there had been flour and bacon, the soldiers might not have become weakened and sick, and yet they fought as the Spanish soldier always has fought. What a contrast between him and the merchant of this city! But there are things which it is better not to air and this is one of them.

XI.—Coaling.

The fleet which left the Cape Verde Islands, which took no coal at Martinique where it touched, and which at Curaçao took on only a few tons in two of the ships, arrived here, as was natural, with the bunkers almost empty. Admiral Cervera prepared to replenish them, and it may be easily imagined how imperative it was to hasten an operation without which the ships were unable to execute a single manœuver, even though their very salvation might depend on it.

Unfortunately, the harbor of Santiago, where there is little movement of shipping, has but very scant means and resources, especially since the breaking out of the present insurrection.

There were only four steamers—the Alcyon, Juraguá, Esmeralda, and Colón. The first two do not possess the necessary requirements for towing launches; the Esmeralda does very well when the sea is calm and there is not much head wind; the only one that has all the necessary requirements is the Colón, but the Colón was having her boiler overhauled and it required a week to finish the work, which was indispensable. Unfortunately, the gunboat Alvarado, which might have rendered good services, was in dock renewing her bottom planks, and the work was very slow.

The army, in its turn, also had a great deal of work on hand which it could not possibly leave, such as taking supplies to the Morro, water to Punta Gorda, and war material and ammunition to both of these places and to the Socapa, and the chiefs and officers were needed for directing all the work undertaken.

The only launches and lighters in the harbor were those of Messrs. Ros, some of them useless, others in bad repair, and a few only in condition to be used; besides these there were those of the Juraguá Company, which were good but few in number, and, as they belong to American subjects, it was not easy for the Government to get them. With such small resources and with so much that had to be done, it will be understood how difficult it was, not to say impossible, to accomplish everything.

To give even an imperfect idea of the lack of appliances of every description, I will mention that the contractor of water, which latter is very bad and for which he charges exorbitant prices, had, for the purpose of supplying the ships, only two small rudder boats, each with two pipes (about four hogsheads), and there were four ships requiring 1,500 pipes each, without counting the destroyers.

Naturally all the demands, requests, and complaints, everything the fleet needed, wanted or desired, went to the comandancia de marina, the *personnel* of which consisted of the commander, the second in command, the aide, the paymaster, three enlisted seamen (cabos de matrícula), one of whom had charge of the provision stores, and two orderlies, and with this *personnel* everything had to be done that was asked for and everything furnished that was wanted.

The army wanted a tug, the military government wanted a tug and launches, and the fleet wanted launches and a tug, and all wanted them badly, and all the services were important and urgent, and at the captaincy of the port we constantly had to solve problems that had no solution, and furnish launches that did not exist and tugs that were not to be found.

The coaling, which went on day and night, progressed very slowly, in spite of everything; for at the two piers where the coal was there was very little water, and at the end of each pier only one lighter could be accommodated without danger of running aground, in which case it would have been necessary to wait for high water to float it again.

There is no end to the time and work which it took to put the Cardiff coal of the navy dépot on board the ships, and though laborers were hired for the Cumberland coal of the Juraguá mines, the ships, which never stopped coaling as long as they stayed at Santiago, never succeeded in filling their bunkers. One detail will show the lack of means available at the port. Although every store in the town was visited and any price offered for baskets, only a very limited number could be found for carrying the coal; it had to be put in as best it could.

There is some work that can neither be understood nor appreciated, that passes by unnoticed and of which people do not even have an idea, because it does not constitute actions of war, more or less brilliant, and which yet can not be kept up nor stood for any length of time. We who belonged to the captaincy of the port finally dined, breakfasted, and slept there—or rather, did not sleep there, for there never was a night when it was not necessary to transmit to the admiral two or three urgent papers, orders, or rather cablegrams, at all hours, and the telephone did not stop a minute and did not give us any rest. Still it was not the work that made the situation unbearable; what soldier or sailor did not work desperately at Santiago de Cuba? No, the sad, the lamentable thing was that, being so anxious to please all, we were unable to satisfy anybody.

The coal belonging to the navy, consisting of 2,300 tons of Cardiff, was taken on at the piers of Bellavista, situated in the western part of the bay. Besides this, General Linares placed at Admiral Cervera's disposal about 600 tons of Cumberland coal from the Juraguá mines and 600 tons from the Sabanilla railway.

The water had to be gotten by the boats of the fleet in bulk at the piers of Las Cruces and at the faucet near the Royal Pier. Some of the ships got their own water by going alongside the first-named pier.

XII.—Opinions as to why the fleet did not go out.

In narrating the events of Santiago, it was not my intention to to make remarks of any kind on them, nor to permit myself comments thereon, as I consider that I have neither the authority, nor the ability (and this I do not say from false modesty), nor the right to do so. My object has been to give a simple account of what I witnessed, what I saw, and what I heard from trustworthy sources, and of the authenticity of which I am certain, feeling sure that in Spain, though the facts are known as a whole, they are not known there in detail; but in the presence of certain insinuations and certain doubts I can not remain silent and indifferent.

Great was the joy caused by the arrival of the fleet among the peninsular element generally and some of the sons of Cuba who truly love us. But after a few days, a number of intelligent and prominent people, or at least recognized as such, showed great impatience and surprise that the ships should remain in port, and never got tired asking what the fleet was doing there and why it did not go out.

It is easy to answer that question.

If Admiral Cervera can be accused of anything, it is an excess of courage. One need only to read his record of service to be convinced of that, and the third day of July proved it only too well. Admiral Cervera received many cablegrams and official letters; no one knew better than he did what was going on in

Spain and in Cuba, and what was then being ordered and required of him, and that Admiral Cervera acted as he should have done admits of no discussion. My only object is to answer the question which so many were asking in Santiago: "What was the fleet doing there?" What was it doing? Well, a great deal.

It is not always great battles or great fights that decide the outcome of a campaign. Napoleon I, by an admirable manœuver, closed in on the Austrian General Marck at Ulm, and the latter had to surrender with his whole army without having fired a single shot.

When Admiral Villeneuve, who unfortunately commanded the allied fleets of France and Spain, learned that Admiral Rossilly, appointed to relieve him, was at Madrid, he preferred to fight with Nelson rather than present himself before Napoleon. So he decided to leave Cadiz, and he called together the commanders of both fleets on the ship Bucentaure. The Spanish objected, on the grounds that, in order to leave Cadiz, they needed time and a favorable wind, that the ships were in need of repairs, had to replenish their provisions and ammunition and complete their crews, that the season was far advanced, and that, if the English were compelled to blockade them in winter, it would be equivalent for them to the loss of a naval battle; that was the opinion of men like Gravina, Churruca, and Galiano.

They added that, moreover, the barometer was very low and that a storm was imminent, whereupon Rear Admiral Magón replied "that what was low was the courage in some hearts." At this insult, the Spanish, losing all prudence and calm, decided to go out in search of the enemy to prove that they still retained their courage. That was all that the French admiral wanted. The combined fleets went out, and what happened at Cape Trafalgar is well known.

Now, then, the question is answered already: the ships were compelling the enemy to sustain with superior forces the blockade of Santiago de Cuba, with all its difficulties and dangers. While our ships were in port, safe from the ordinary dangers of the sea, using hardly any coal, not exhausting their engines, and waiting for a favorable opportunity to manœuver, when and as best they could, the hostile fleet was obliged to cruise on the coast day and night, using a great deal of coal, constantly doing sea service, which is always laborious, especially in time of war, exhausting their engines, and exposed to the danger of having to abandon the blockade in case of a storm from the south or east, still more if the season of cyclones should come.

It is certainly true that a victory can be achieved without the necessity of giving battle, so much so that, if it had been possible for us, besides the ships that were at Santiago, to have two at Cienfuegos, for instance, and two more at Nuevitas, which ports are well suited for placing lines of torpedoes, owing to their narrow entrances, there is no doubt but that the Americans, who, outside of the ships they had in the Philippines, had sent their whole fleet to the island of Cuba, would have had to blockade those three ports with forces superior to ours and to keep watch at Key West if they did not want to expose themselves to a serious disaster, or would have had to force one of the ports, thereby exposing themselves to a hecatomb; and we only need think of the number of their ships to understand that they could not successfully threaten so many points; though they only had to deal with Santiago and had almost all the ships of the fleet in front of it, they would have found it necessary to desist from taking the offensive.

The foregoing shows that ships do not necessarily have to give battle in order to obtain results. Those in Santiago harbor succeeded for forty-six days in keeping before the mouth of the harbor a vastly superior fleet, which performed no special acts of prowess except to throw a hail of projectiles which comparatively did very little damage. One could not obtain better results with less work; and if provisions had not been wanting in Santiago, God knows, if our fleet had remained there, to what extremes impatience and despair might not have carried Admiral Sampson!

XIII.—The Blockade.

As I have already given a description, though very deficient, of the sites and places that were the scene of these events (IV: Scene of Events), and of the miserable resources we had for their defense, it will be easy to understand them by remembering and fixing the attention on what has been said.

I have already stated that on the 18th of May, the Saint Louis, equipped for war, and a gunboat whose name could not be ascertained, fired about 80 shots, which were answered by Punta

Gorda, the only battery that was then in condition to answer the attack. If it had happened a few hours later, one of the 16-cm. Hontoria guns of the Socapa could have been fired, but as stated, it was not mounted until the night of the 18th. The hostile ships disappeared to the east. The next day, the 19th, the Spanish fleet, coming from Curaçao, entered the harbor and commenced to coal on the 20th.

21st.—This day, a ship coming from the south came close to the mouth of the harbor, then shaping her course westward. At 10.30 P. M. the Morro telephone gave notice that two ships had been firing on Punta Cabrera for 15 minutes, ten shots in all. Probably they were firing at Colonel Aldea's forces, which covered that part of the coast.

22d.—At 7 A. M. the lookout signaled a steamer to the east and another half an hour later. We learned from the Morro that one of them appeared to be the same that had been sighted the day before; the other was a three-master. Both of them were thought to be hostile vessels because they were going very slowly and reconnoitering the coast. The new one had three smokestacks.

At 11.30 the vessels were south of the Morro (that is, in front of it), proceeding very slowly westward, where they disappeared at half-past four.

23d.—At 5.45 a vessel was signaled to the south and an hour later two to the east. At 9 the Morro said that one of the three vessels had three smokestacks, the same that had been sighted the day before, and one was a battle-ship, and that flag signals were being made.

At 11.30 a vessel was signaled to the west; at 12.30 the Morro said that the vessel just arrived had three masts and three smokestacks.

At 4.10 we learned by telephone that one of the four vessels had disappeared to the south and the others were coming closer to the mouth of the harbor.

At 7 the three ships disappeared, one to the east and two to the south.

24th.—At 2 o'clock the lookout signaled two steamers to the south. The sky was clouded and nothing could be distinguished beyond a certain distance.

At 11.45 the destroyer Plutón went out.

At 12.30 four hostile vessels were distinguished, though with difficulty, owing to the cloudy weather, to the east of the mouth of the harbor.

When seeing the Plutón go out, one of them shaped her course to the westward and passed close to the destroyer without being able to attack her, then proceeded westward. The others started in the same direction, also in pursuit of her, but without success, as the Plutón had naturally eluded meeting them.

The four vessels disappeared to the westward.

At 2 o'clock, the Spanish flagship (Infanta Maria Teresa) started up and went alongside the Las Cruces Pier for water.

At 5.30 two vessels were signaled to the south: they disappeared in that direction after dark.

25th.—At 6 o'clock two steamers were signaled, one to the south and one to the west.

At 7.30 the Cristóbal Colón started up and shortly after cast anchor again.

At the same hour, the Morro reported that one of the two vessels signaled was apparently heading toward the harbor at full speed, and the other seemed to be chasing her. Three-quarters of an hour later it was reported that the vessel appeared to have been captured at quite a distance from the mouth of Santiago harbor, and that both were going south, the captured vessel ahead and the other following.

The Infanta Maria Teresa sheered off from Las Cruces Pier at 1 o'clock P. M., and the Oquendo then went alongside, also to take water; the former anchored again in the bay.

At 2 o'clock the Vizcaya cast anchor south of Cay Ratones, near Cajumas Bay. The Cristóbal Colón anchored south of Punta Gorda.

26th.—At 2 o'clock P. M. the Oquendo left Las Cruces Pier and anchored again in the bay.

The position of the fleet was as follows: The Cristóbal Colón was at anchor south of Punta Gorda, close to it, presenting her broadside to the mouth of the harbor, in line with the channel to which she presented her guns, so as to be able to attack the enemy in case he should try to force it.

The Vizcaya close to Cajumas Bay, facing the same as the Colón so as to unite their fire in case the enemy should succeed in passing Punta Soldado.

The Maria Teresa and Oquendo south of Cay Ratones, so as to defend the channel of Punta Gorda as well as the general anchoring place and the city. During the day three ships were sighted to the south, and disappeared shortly after in the same direction.

27th.—At 6 the lookout signaled two vessels to the south.

At 11.30 it signaled five more ships. There were now seven in sight.

At 12.15 General Linares went to the Morro in the steamboat of the captaincy of the port.

At 12.30 four more ships were sighted; total, eleven ships.

Of the eleven ships in sight, four are battle-ships.

At 2.30 P. M. another ship arrived.

At nightfall General Linares returned from the Morro. The ships disappeared to the south.

28th.—At 6.15 the lookout signaled a vessel within 5 miles of the Morro, and at noon she disappeared to the south.

At 4.30 P. M. six large ships were signaled, disappearing to the south at nightfall.

29th.—At daybreak the destroyers Plutón and Furor went out to reconnoiter, returning at 8.

During the day they anchored in the bay; at night they cast anchor at the Socapa and at Nispero Bay in order to guard the entrance of the harbor.

General Linares went to the Morro in the tug Alcyon.

At 7, seven hostile ships were sighted reconnoitering the coast, at a distance of about 8 miles; they withdrew to the south before dark.

30th.—At 5.30 the hostile fleet was signaled approaching to within 9 miles of the harbor. It consisted of seven ships.

At noon three others arrived from the south and joined the former.

31st.—At 5.45 the lookout signaled eleven ships to the south.

At 2 P. M. gun fire was heard. The lookout reported that the coast was being fired on.

At 2.40 Punta Gorda battery opened fire, ceasing again shortly after.

The ships of the Spanish fleet hoisted their battle-flags and fired up their boilers.

At 2.30 the firing was quite lively.

By 3 it became slower and ceased at 3.30.

The enemy had been firing on the Morro and Socapa batteries, without any casualty in either.

The ships disappeared, as usual, to the south before dark.

Thus end the events of the month of May, insignificant on the whole and only a prologue to those that were to follow.

During the days of May 20th to 22d, the insurgent chief Calixto Garcia, with a numerous contingent of troops and artillery, attacked the village of Palma Soriano on the Cauto river. General Vara de Rey, at the head of 1,000 men and two guns, repulsed the hostile forces, routing them and killing a great many. On our side we had 16 wounded. This operation of the soldier hero, simulating a surrounding movement by crossing the Cauto at three or four fords, and pursuing the rebels 2 miles beyond Palma Soriano, was due to the skilful distribution of the scant forces of the line of observation. This line, as will be readily understood from the chart at the end of the book, was weak, very weak, in almost its whole extent. It was, indeed, work that deserves praise, to guard, patrol, and sustain strategic points, cultivated land, coasts, roads, and railroads, with such a small and weak contingent of troops. And the forces that we were expecting from Havana, and the arrival of which had been announced, did not appear.

As a collier was being expected, it was supposed that the vessel captured on the 25th was the one. It is possible; but, on the other hand, it may not have been. In any event, there was much surprise expressed at Santiago that, since the hostile fleet was not in sight, but only one or two vessels, Admiral Cervera had not prevented the capture, or at least recovered the prize.

The reason why he did not is very simple. Our fleet had taken on board all the Cardiff coal that was at the navy depot, without succeeding, as has been seen, in filling its bunkers, and there remained only the 1,100 tons of Cumberland coal of which Gen. Linares could dispose; this latter coal is inferior to the former, and I believe it is hardly necessary for me to point out how important it is that a fleet should have good fuel; it may be its salvation at a given moment; consequently the fleet, which had the prospect of having extremely difficult manœuvers of the highest importance to execute, could not afford to waste even a single piece of coal to no purpose.

The capture took place a long distance from the mouth of the harbor; before a ship could weigh anchor, clear the channel, get up full steam and traverse that distance, at least three hours must elapse, and where would have been the captor and the prize by that time? And even granting that the former could not bring the latter in safety, would he allow it to fall into our hands? Certainly not. Two gunshots would have sunk her very quickly, especially if, as was believed, she had a heavy cargo; and the Colón, or any other ship that had gone out on that errand, would have consumed, probably to no purpose, a quantity of coal which it was imperative to keep for much more important and less hazardous operations than pursuing merchant steamers equipped for war and taking or recapturing prizes. Moreover, from the 22d to the 28th, the swell of the sea prevented the ships from going out; the pilots of the harbor were not willing to take them out, saying that in view of the state of the sea, they might touch bottom, especially the Cristóbal Colón.

XIV.—The Volunteers.

Although the comparison may perhaps not be considered very apt, I might say that the month of May was the paradise of the blockade, while the month of June was its purgatory, and the month of July its hell.

The appearance of the first hostile ships before the Morro of Santiago, as the natural result of the war decided upon by the Government of the United States and accepted by ours, and the noise of the first gunshots caused both consternation and curiosity among the inhabitants of the city; but as man becomes accustomed to everything, so the situation, which at that time was, if not dangerous, yet certainly very unpleasant and disagreeable, was finally looked upon with indifference.

The boats of the fleet were constantly going back and forth between the ships and the piers to supply the innumerable wants of the former, and gave to the marina an aspect of animation which it never wore in normal times. The Alameda, where the music of the Santiago regiment played, as usual, on Sunday evenings, by order of the military authorities who were desirous of raising the spirit of the inhabitants as much as possible, and the Plaza de Armas, where the drums continued to beat the tattoo every Thursday and Sunday, were always full of people, although so many had left the city. People fond of giving sensational news, especially those who took pleasure in inventing it, had a wide field and plenty material to satisfy their desire; and any one having patience and curiosity enough to collect the news floating through the city might have written a very original and amusing book.

The children were playing war, pelting each other with stones inside and around the city, divided into parties in command of a Cervera of ten summers or a Sampson of twelve Aprils.

The different corps of volunteers were considerably increased by the many men who came to swell their ranks, especially chiefs and officers; the city was full of sabers, machetes, stars, and galloons, and I believe not even in Berlin, the capital of the most military nation of Europe, are as many uniforms seen as we saw in this city, usually so quiet. Even the clerks of the guard-house and employees of the civil guard armed themselves with carbines and machetes.

And while I am talking of the volunteers I will finish their history to the end, which is not without interest.

After sunset and during the first hours of the night the volunteers would gather at the Alameda, which they filled completely, divided into more or less numerous platoons, which officers of the regular army, or their own officers, undertook to drill, and at the first gun or the first blast of the bugle, they reported promptly, especially the chiefs and officers, at the posts which had been assigned to them beforehand.

Every night a guard of twenty-five men, commanded by an officer, occupied the large shed of the Alameda and placed its sentinels, and from that time until dawn the noise of musket butts striking on the wooden floor was constantly heard, and by many people mistaken for gunshots, and the "Who goes there?" addressed to every moving object was an evident proof of the extreme vigilance observed, and showed that it would not be easy to surprise them.

The firemen were always on hand whenever they were needed at the pier to take the wounded from the Morro and Socapa to the hospital on their stretchers, and their energy, good will, and zeal can not be sufficiently praised.

On the 1st, 2d, and 3d of July, as will be seen later, a large number of volunteers hurried to the trenches of the third line, where they fought the enemy like brave men, and where some of them were wounded.

Unfortunately, after that day, with a few honorable exceptions, the spirit animating them underwent a complete change; their enthusiasm became indifference, their valor prudence; they left the trenches to which they never returned, and exchanged the uniform for civilian's clothes and the gun or machete for the measuring-stick or weighing scales.

Why this change? There is an explanation for it. It is an error to suppose that the soldier is braver than the volunteer; there is no reason why he should be; they are both Spanish. But the soldier has military habits and discipline which the volunteer lacks; he has chiefs and officers whom he must needs respect and obey, the volunteer has not; and that is the whole explanation.

As long as the enemy was making attacks which it was necessary to repel the volunteers fought with energy and enthusiasm; but when the battle and excitement were over, when the period of trenches arrived, with the hot sun in daytime and dampness at night, with rains, sickness, privations, and want, in a word, the hour of suffering in silence and with resignation, the hour of subordination, of sacrifice and duty, then, one after another, under this pretext or that, they returned to the city, determined not to go back.

The circle narrowed more and more, the probabilities of capitulation and death increased as those of triumph and success diminished, and then it was that they remembered their families, their own interests, and themselves, that they took off their uniforms, which, in their opinion, might cause them trouble, and, not considering themselves safe in the city, they went to hide at Cinco Reales, Las Cruces, and on board of merchant steamers, or any other place where they thought themselves safe from projectiles, and there were even those who emigrated to El Caney and Cuabitas, occupied by the Americans and the insurgents respectively.

What I relate I do not know from hearsay; I saw it myself at Cinco Reales, upon my return from the cruiser Reina Mercedes, sunk in the entrance of the harbor, where I had gone by orders of the commander of marine in order to report to him on the exact position then occupied by the vessel. At Cinco Reales I found many in hiding, in civilians' clothes, some with their families and others alone.

But while men who had carried the gun did such things, others who had girded the sword, with a show of doing great things, did even worse.

XV.—Waiting.

The events of the month of May, although they are not, or rather do not appear to be, of great importance in themselves, because there were no special movements on the part of the enemy and no casualties of any kind on ours, are in reality of great importance, and their consequences have had great influence and weight on the result of the war, which has been decided, so to speak, in the waters of Santiago de Cuba and in front of the trenches in this precinct.

If we take into consideration the position of Santiago de Cuba, situated at the southern extremity of the island, and therefore at a comparative distance from the United States and Key West, the base of operations of the Yankees; the topography of its harbor, difficult in itself to force; the absence of military importance of the city, which is not a stronghold or even a military city, and the scarcity of roads and railways so that it is almost cut off from communication with any important or strategic point, it is not too much to assume that the Americans had no idea of making great demonstrations or operations, but thought that it would be sufficient to blockade it, and throw in a few projectiles as they had done at other cities on the coast, and a proof of this is that, until the 18th of May, that is, nearly a month after the declaration of war, not a single hostile vessel was seen, and the two that appeared then were a merchant vessel equipped for war and a small gunboat, which, after reconnoitering, disappeared to the east.

But the arrival of the Spanish fleet, though composed of only four battle-ships, but these the only ones of that class which we had in the island, and therefore the only ones that could inspire any fear, the absolute necessity of replenishing them with coal, which took a number of days, because, in view of the scarcity of facilities of any kind it could not be done in less time, compelled the enemy to make the city, and especially the harbor where the fleet was at anchor, their objective, although they had not taken much thought of it at first; to concentrate upon this objective all their forces on sea and on land, and to take for the scene of the war one which was least adapted for their plans and which they had least thought of choosing.

When did they learn that our ships had anchored in the harbor?

I do not know; nor do I believe that anybody in Santiago knows it. If the St. Louis and the gunboat which has been mentioned several times returning from Guantánamo on the 19th, where they went presumably to continue the blockade when they left these waters, there is no doubt but that they could see our ships and some people think that they at once notified their admiral, but I doubt it, because it was not until the 27th that ships appeared in such numbers as would make it possible to check or defeat ours.

It might be said in answer to this that the hostile fleet may have had a thousand reasons, which we could not know, for this delay in assembling and appearing at the harbor. It is possible, but in that case, if the enemy knew ever since the 19th, what had happened, why did they continue to appear in small numbers before the mouth of the harbor, exposing themselves to serious trouble? I do not believe that the enemy received any information on the subject, or at least complete evidence, until the 24th, when the vessels which were cruising in Santiago waters, saw the Plutón come out and go back again, for they knew that she accompanied the fleet and formed part of it. It was three days later, the 27th, that eleven ships appeared, four of them, at least, battle-ships. This interval of time was necessary, of course, to advise the hostile fleet, which was perhaps between Cape San Antonio and Havana, or Cape San Antonio and Cienfuegos.

In any event, the operations of the month of May assumed great importance, for the harbor remained closed, where since before the declaration of war no provisions of any kind had entered, if we except those which the small English schooner already mentioned brought from Jamaica, and which are hardly worth taking into consideration.

Another problem: Why did the hostile ships which remained all day long in front of the mouth of the harbor disappear at dark instead of continuing to watch it during the night? I do not know that either. The whole coast is accessible and the ground so high that it can be distinguished perfectly even in stormy weather, so that there was no danger in remaining there in calm weather such as we have had all this year (for even in that Providence had favored them), and what I say is true, as shown by the fact that afterwards they never left the mouth of the harbor for a single moment, day or night, as will be seen.

Was it perhaps because they had become convinced of the difficulty of forcing the harbor, especially with a fleet inside, and wanted, by opening a passage, to give the fleet a chance to come out in order to take refuge in another harbor less difficult of access? But such tactics might have had fatal results, because if our ships should reach Havana harbor, a few hours from Key West, under the protection of its 300 guns, and united with the other warships that were there, the situation would have become materially changed, and the Americans might have had a chance to regret such tactics. That they should have made such a mistake is not to be thought of; besides, if that had been their intention, they would not have maintained such vigilance during the day. Were they simulating a retreat to return at night to the harbor, without lights, so as not to be seen? That is not probable; in order to see the mouth of the harbor they must have been seen themselves from the heights of the Morro or Socapa, where the strictest watch was also exercised. I suppose, for I can not think of anything else, that, not having been able as yet to unite all their naval forces, they did not want to run the risk of a battle at night with a fleet that had destroyers, the number of which they probably did not know, and did not learn until later, through the secret information which they probably received from the insurgents.

But all this is only supposition and hypothesis, no doubt entirely erroneous. The incontrovertible, undeniable fact is that, on the 27th, the enemy appeared with forces much superior to ours and remained all day long opposite the Morro, retreating at night, or simulating retreat. Thus ended the month of May.

XVI.—The Merrimac.

June 1st.—At 6 o'clock the lookout signaled the hostile fleet in sight, consisting of thirteen ships; five battle-ships and eight merchant and warships, among them one torpedo boat.

At 7 o'clock gunshots were heard.

At 12.30 the fleet started up, moving away from the harbor from which it was about 6 miles distant; half an hour later it reversed its course and came again closer.

At night the Spanish fleet changed its anchoring place.

The Maria Teresa and Vizcaya anchored south of, and with their broadsides toward, Cay Ratones and were forming the first line for the defense of the harbor. The Colón and Oquendo anchored north of the same Cay and were forming the second line.

2nd.—At 5.30 nineteen ships appeared at the mouth of the harbor, at a distance of about 5 miles.

At 7 the Morro reported that they were going to fire a few shots to discharge some of the guns.

3rd.—At 3.30 gunshots were being heard toward the mouth of the harbor and the firing became very lively.

At 4 o'clock it was learned at the comandancia de marina that a merchant vessel had come very close to the mouth of the channel; that the batteries had fired at her and she had not answered; and at that moment she was already inside; shortly after she passed by the bow of the Reina Mercedes, which, it will be remembered, was moored between the Socapa and Cay Smith, with her bow towards the channel which she was defending with her two 16-cm. Hontoria guns and Whitehead torpedoes.

By 4.20 the firing, which had been very violent, ceased.

At 4.30 it was learned that the hostile ship had gone down in the mouth of the channel, close to Punta Soldado, but without obstructing it.

At 5.30, it now being daylight, very slow firing was again heard and ceased at 6.

At 5.30 the commandant of marine went to the mouth of the harbor in the steam launch.

When he returned, we learned that one of the merchant vessels forming part of the American fleet, called the Merrimac, with two masts and one smokestack, larger than the Méjico, had forced the entrance at 5.30; that she had been sunk in the channel close to Punta Soldado, by the guns of the Mercedes and the rapid-fire guns of the battery below the Socapa, and was lying in the direction of the Socapa, without obstructing the entrance or preventing our ships from going out, and that one lieutenant and seven sailors forming her crew had been captured and were on board the Mercedes.

Besides the firing on the vessel from the guns, the Plutón launched two torpedoes and the Mercedes two more. Two submarine mines were discharged from the first line and one from the second.

During the events related above, General Linares was at the Morro, where he had repaired by land on receipt of the first news. At daybreak, General Toral, military governor of Santiago, came to assist the navy with a force of regulars and volunteers.

At 7 a company went to reënforce the forces at the Socapa and the Morro.

At 7.30 the forces that had come to assist the navy withdrew.

At 11 p. m. firing was heard at a great distance in a south-easterly direction; it ceased at 12.15. The fire was extremely slow.

As may have been noticed, on June 1 the enemy appeared before the Morro with thirteen ships, five of them battle-ships and eight merchant and war vessels; that is to say, with forces superior to ours, in number as well as caliber of armament, and also from the fact that they were better protected than ours, as may be seen from the report of the United States Navy, and as unfortunately we found out ourselves later. From that time on the hostile ships, which were afterwards increased in number, established day and night a constant watch, without withdrawing at nightfall, as they used to do. Probably they suspected—for they never lacked advices and secret information—that our fleet, for want of provisions, would before very long be compelled to go out, and that is what they were waiting for.

On the 2d, nineteen ships were present.

At daybreak of the 3d, the Merrimac forced the entrance of the harbor, at 3.30, with the result above set forth.

In spite of the time that has elapsed, we, at Santiago, have not succeeded in ascertaining definitely—though it is probably known in Spain from American newspapers that are in the habit of publishing everything—what was the real object that the Merrimac had in view.

She had guns and did not fire; she had torpedoes, though imperfect and primitive, if I may be permitted the expression, or rudimental, which she did not use; if she was trying to explode our mines, she did not accomplish her design; and, finally, she had 2,000 tons of coal on board. The lieutenant who commanded her refused to state the object of his maneuver, saying only that it was made by order of Admiral Sampson; later, he said to Mr. Ramsden, British consul, that if the vessel were examined, it would be found that she carried torpedoes, as indeed was the case. Therefore, it may be reasonably supposed that the object was to sink the vessel across the channel, so as to obstruct it and prevent our ships from going out; and having made sure of that, to use part of their ships in other operations; and if the vessel did not come to lie across the channel and did not obstruct it, it was because she lost control of her movements, her rudder having been disabled by some projectile, so that she went down where it suited her least.

There is another fact in this connection which may and should arrest the attention of experts in that subject: The Plutón launched two torpedoes, the Mercedes two more, all of them Whitehead; two mines were discharged from the first line and one from the second; and yet the vessel was not blown up and passed both lines in safety, which shows that the effect of torpedoes is moral rather than material, and that it is not easy to discharge them at the right moment. To do so requires a degree of experience, a range of sight, and a presence of mind not easily found united in a single man. The occurrence to which I have reference demonstrates this very clearly.

During the day the officer and seven men of the Merrimac, who had first been taken on board the Mercedes, were temporarily transferred to the Morro.

From 11 to 12.30 in the night, the hostile ships were firing, though slowly, outside of the harbor and towards the southeast. The object of this has never been ascertained.

I have several times spoken with General Ros, governor of the Morro, and he has always repeated these and similar words: " From the beginning of the hostilities to the end I have remained in the castle, from where, as you know, everything can be seen and observed. Sooner or later I have always learned the object of everything the enemy has done and the reason for it; but the firing of that night, though I saw and heard it myself, I have never understood. I believe they were firing on some ship they saw, or thought they saw; but it may be that they were firing on the land; but I believe in that case the object and result of the firing would have become known sooner or later."

That same day Captain (General) Parades, second in command of the fleet, disembarked from the Cristóbal Colón and embarked temporarily on the Mercedes, where he remained until the 21st, taking command of all the defenses at the mouth of the harbor.

XVII.—The Blockade Continues.

June 4th.—There were to be seen at the mouth of the harbor seventeen ships: Six battle-ships, five warships, and six merchant vessels.

At 11.30 a. m., the second commander of the local naval forces (being the writer of this book), as judge, accompanied by the aid of the captaincy of the port, Mr. Leguina, as secretary, and the Government interpreter, Mr. Isidoro Agostini, went to the Morro in the steam launch of the captaincy of the port, for the purpose of taking the depositions of the lieutenant and seven men who had been taken prisoners.

The former, Mr. Hobson, 27 years old, born in the State of Alabama, is a lieutenant in the corps of naval constructors, who, in the United States, study in the naval college, and those first promoted are assigned to that corps; I state this so that it may not seem strange that he commanded the Merrimac, for, as they are officers of the Navy, they can build and command ships.

Upon learning the object of the visit, the prisoner, from whose room a great extent of the sea and part of the blockading fleet could be seen, asked why the British Consul, who was in charge of the United States Consulate, was not present when his deposition was to be taken, and he wanted to know whether I belonged to the army or the navy; what might be the consequences of his statement; by whose authority he was being examined; and he stated that, since he had been taken prisoner by Admiral Cervera himself in his own boat (as was true), it was his understanding that he could and should answer only Admiral Cervera, or some one delegated by him. And although all this was said in the very best form and with a thousand protestations of his respect and deference for me, it did not prevent our positions from being reversed, and far from my asking the prisoner questions, it was he, on the contrary, who asked them of me. I told him so, asking him through the interpreter to state categorically whether he was disposed to answer. He replied he was ready to answer the questions which he thought he ought to answer, but not those which he deemed untimely. Therefore, and in order not to lose time, I at once asked him one question which I knew beforehand he would refuse to answer, namely, by whose order and for what purpose he entered the harbor; he replied: "By order of Admiral Sampson; the second part I can not answer." I then deemed my mission at an end and had the fact set down.

A few days later, this officer was transferred to quarters on the Reina Mercedes that had been prepared for him, and the seven men to others on the vessel, where they remained until they were released.

As I left the Morro and stood on the esplanade in front of it, I had an opportunity for the first time to admire the spectacle that presented itself to my eyes; I say "admire," for the picture was truly worthy of admiration.

The evening was most beautiful; the sea was as smooth as a lake, there was hardly any wind and the sky was perfectly clear.

At a distance of about five miles, seventeen ships could be seen: eleven warships, among them seven battle-ships and one torpedo boat, and the other six merchant vessels, the nearest one about six miles from the harbor, formed a large arc, one extremity of which was at Aguadores and the other at Punta Cabrera. The largest and most powerful ships were in the center. Among them were the Iowa, Indiana, Brooklyn, and New York; the latter two may be easily recognized by their three smokestacks. The fifth was presumably the Massachusetts; and finally the Texas and Amazonas. The New York and Brooklyn taking advantage of the state of the sea, had a merchant steamer alongside and were coaling. All of them had their engines stopped and their bows in different directions according to the current. From time to time, one of them would move a short distance forward and then return again to her place. Among the merchant vessels were specially noticeable the Saint Louis (the first vessel that had been seen at Santiago), a huge trans-atlantic steamer of over 10,000 tons, which looked larger than any of the other ships, including the armorclads, and a steam yacht of great speed, very small, on the contrary, and which looked like a ship's boat. This is the yacht that was in constant communication with Punta Cabrera. There also was a torpedo boat or destroyer. A few days later, I saw the same spectacle from the high battery of the Socapa, and I shall never forget it.

Before I continue, I will state that on May 26, the cable had been cut at Cape Cruz, so that communication with Manzanillo was interrupted until June 17, when the connection was reëstablished.

5th.—The American fleet could be seen at the mouth of the harbor, being the same ships we had seen the night before.

General Linares returned from the Morro at 8 o'clock p. m. and ordered the launches and a tug to be gotten ready to take 150 men to the mouth of the harbor.

At 10.30, a chief, two officers and 120 soldiers embarked and went out in a launch towed by the Colón, assisted by the Alcyon; the tugs returned at 1 o'clock at night.

At 2 o'clock in the morning, through the fault of a collier coaling near the hut of the English cable at Las Cruces, said hut was burned; it was an accident, but none the less deplorable.

XVIII.—The Bombardment Increases.

June 6th.—Eighteen ships were visible at the mouth of the harbor. At 7.30 the lookout reported that the ships were starting up and approaching.

At 8.30 ten ships—the Iowa, Indiana, Massachusetts, Brooklyn, New York, Texas, Amazonas, Minneapolis, and two other warships—forming two divisions, opened fire, the first division on the Morro and Aguadores, the second on the Socapa; one ship was detached from the latter division to bombard Mazamorra and adjoining points on the coast, where the column of Colonel Aldea (Asiatic battalion) had detachments and was operating.

When the American fleet opened fire, it was so intense and the shots followed each other in such quick succession that it might have seemed like a fusillade if the mighty thunder of guns can be compared with the crackling of small arms.

By 9 o'clock it became somewhat slower, shortly after reaching again the same intensity, then decreasing once more at 10.15, and again becoming terribly intense at 10.30.

At 11.2 it ceased.

Punta Gorda battery fired only 7 shots.

At 12.15 intense firing was heard again in the distance to the east; it ceased at 1.45.

At 2 p. m. there arrived at the royal pier a boat from the Reina Mercedes, towed by her steam launch, with Lieutenant Ozamiz, bringing three seriously wounded sailors, who were taken to the military hospital. This officer reported the death of Commander Emilio de Acosta y Eyermann, second in command of the cruiser, and of five sailors; also, that Ensign Molins, one boatswain, and several other sailors had been wounded; their names could not be ascertained owing to the condition of the ship, nor could even the exact number of wounded be stated, as it had been necessary to extinguish two fires on board.

At 2.45 a private boat arrived at the pier, carrying a sergeant and a wounded soldier from the Mazamorra detachment. They were also taken to the military hospital.

There were no more remarkable events during the night.

Ten warships, eight of them battle-ships, divided into two divisions, opened fire shortly after 8 a. m., on the batteries at the mouth, and by elevation on the bay. During the first moments, the firing was so intense that it resembled one prolonged thunder. In fact, I had no idea that any firing could be as terrific as that of those ten ships. Much has been said of the bombardments of Sebastopol and Alexandria, but I do not believe that they could have been as terrible as the bombardment we suffered that 6th day of June—a day which the inhabitants of Santiago will never forget. I might write pages about it, and even then would probably not give the faintest idea of what it really was.

The hostile ships (see list of ships and armaments) had at least 120 large guns, that is to say, of 14, 20 and 32-cm. calibers, and about 80 small-caliber guns, that is to say, of 57 and 42-mm., or a total of 192 guns, for they fired with guns of all sizes; and as I am far from wanting to exaggerate and since the guns of the two sides of a ship can not be fired at the same time (those mounted in turrets forward and aft can), I will say that 91 guns were firing upon four 16-cm. *muzzle-loading* guns at the Morro and two 16-cm. breech-loading Hontoria guns of the Socapa battery.

I do not count the guns of Punta Gorda battery, which fired only seven shots; for the Americans, in spite of their enormous superiority, still had the —— prudence of avoiding it and not engaging it because it was not in line. Before the eloquence of numbers, anything else that I might say becomes unnecessary.

How did it happen that the Morro was not razed to the ground and that its guns and those of the Socapa were not dismounted? How did it happen that those who served these guns were not buried under the ruins? I do not know; that is all I can say; and those who were in those forts may be sure that, since they were not killed that day, they will die of old age.

Captain Concas, who is very clever at computations of a certain nature, counted at different times the number of shots fired in a minute, and his deduction is that about 8,000 projectiles were fired; though this figure may appear exaggerated at first sight, it is not so in reality; the firing lasted 175 minutes, which would give an average of 45 shots per minute. I believe, if anything, the computation falls below the truth.

I have always believed that the hostile fleet, which, by means of the yacht referred to, communicated with the insurgents on the coast by way of Punta Cabrera, knew everything that was going on in Santiago as well as in the harbor and the position of our ships. But if I had had any doubts on that subject, they would have been dispelled that 6th day of June when I saw the aim of their projectiles. Most of them dropped in the bay in the direction of the Maria Teresa and Vizcaya, which were covering the first line, and it was a miracle that both of them were not seriously damaged; for the large-caliber shells fell all around them; there were moments when it seemed as though some had hit them, especially the Vizcaya.

They were also perfectly acquainted with the position of the Mercedes, which is proved by the fact that the ships to the east, being the division which bombarded the Morro, were firing their projectiles right at the cruiser, and though protected by the hill of the Socapa, she received in her hull and rigging 35 shells, causing two fires, one of them quite extensive, being in the paint locker forward.

Commander Emilio Acosta y Eyermann was directing the extinguishing of the fire in the forecastle, when a large shell cut off his right leg at the hip and also his right hand, mutilating him horribly. But he lived for half an hour after that and kept on looking after the fire, as I was told by Mr. Ozamiz, who was close to him in those critical moments. I do not like to think of it; he had been a fellow-student of mine at college and our old friendship had always remained the same. As there was no safe place in the ship, his body was placed on a cot and taken to the Socapa coast; five soldiers who had been killed the same day were also carried there, and all of them were covered with the flag which they had been defending and for which they had died. May he rest in peace, this first chief of the navy killed in this war.

The large projectiles shot through the space across the bay, causing a tremendous noise which only those who heard it can understand; some fell on the opposite coast (to the westward), raising, as they exploded, clouds of dust and smoke; others could not be seen falling, which proves that they must have dropped in the hills at a great distance. This explains that they did not only reach the city, but went thousands of meters beyond.

Toward evening, the ships also fired twice on Daiquiri, probably at the forts and the detachments in the mineral region and at Firmeza, but without any effect worth mentioning. The high battery of the Socapa (two 16-cm. Hontoria guns) fired 47 shots; that was all they could fire, because during the bombardment the ships were hidden most of the time through the smoke.

The inhabitants of Cay Smith had to take refuge in the northern part, which is very abrupt, and many were in the water up to the waist; if they had not gone there, most of them would have been killed, for nearly all the dwellings which were located in the southern part suffered from the effects of the shells. The following day the Cay was abandoned and the inhabitants transferred to the city.

Lieutenant Julián Garcia Durán was appointed second in command of the cruiser Reina Mercedes; he had arrived a short time before in command of the merchant steamer Méjico, with torpedo supplies, which he landed at the port of Guantánamo.

Later, after the Mercedes sank, this same officer was placed in command of the naval forces that occupied the Socapa; and, later, of the whole navy encampment, until they were embarked and taken back to Spain.

XIX.—The Firing Continues.

June 7th.—At daybreak nineteen ships in front of the mouth.

At 9.15 the body of Commander Emilio Acosta was brought on shore.

At 9.30 the funeral procession started, headed by Admiral Cervera and Generals Toral and Rubin, and including, in spite of the rain, the civil and military authorities of the city, delegations from all the different divisions, and a great many private citizens. On both sides of the body walked the battalion of volunteers and the company of guides, the only forces that were in the city, with the music of the Santiago regiment.

At 6.30 p. m. the ships increased the distance that separated them from the coast.

The French cable had been cut, and we were not in communication with Guantánamo.

8th.—Nineteen ships were in sight at daybreak, about 6 miles from the mouth.

During the night the fleet had constantly thrown its search-lights on the coast.

9th.—At daybreak eighteen ships, at a distance of about 7 miles.

The steamer Tomas Brooks delivered 25 planks at the mouth of the harbor, which were attached to a steel cable stretched from Cay Smith to Punta Soldado, the object of the planks being to keep it at the surface of the water; the cable was laid to prevent the passage of any torpedoes which the enemy might attempt to send into the harbor with the entering tide.

10th.—At daybreak the eighteen ships of the preceding day were to be seen about 10 miles distant. At 7 o'clock another one, a merchant vessel, arrived from the south.

The Plutón and Furor went alongside the steamer Méjico, one at each side, to rest from the service of the night.

At 11 the lookout made a signal, taking it down shortly after, that fire was being opened. Nothing was heard in the city.

The Morro said that the enemy had fired upon Punta Berracos, but had stopped very soon.

During the night the American fleet continued to examine the coast by means of the search-lights.

11th.—Seventeen ships, some 6 miles distant, others 10.

12th.—The same seventeen ships, from 5 to 6 miles distant from the Morro.

13th.—Fifteen ships, 6 miles from the harbor.

14th.—At 5.15 the enemy opened fire on the mouth of the harbor; it ceased at 6.50.

The projectiles fell toward Cajuma Bay, close to the Vizcaya.

Only one ship kept up the fire on the Morro and Socapa, both batteries answering it.

At the latter battery Ensign Bruquetas and two sailors were slightly wounded.

At 10 General Linares went to the Socapa and the Morro, returning at 12.30.

The enemy continued the fire during the night, aiming his projectiles upon the coast, especially above the mouth of the harbor.

15th.—At daybreak seventeen hostile ships in sight, among them the Vesuvius, this being her first appearance before the harbor.

The Vesuvius is a vessel of 900 tons displacement and of peculiar construction, being very long, narrow, and low. She is the only one of her class in the world, and throws, by means of guns or pneumatic tubes, dynamite bombs or projectiles a distance of about 2 miles; they are probably provided with a screw; nobody knows them exactly. I do not believe this vessel, though it may cause serious destruction, would be able to sustain a fight with another, even though smaller, for the reason that the range of her projectiles is very short and she has no protection.

From the 7th to the 15th the hostile fleet hardly threatened the batteries which defended the harbor, nor the coast either, contenting themselves with watching it incessantly day and night.

In the city nothing appeared to have changed, and yet the situation was very far from being what it was a month ago.

In the stores many articles were wanting, and those that could be had brought fabulous prices. Unfortunately, one of the first articles that gave out was flour, and no bread could be baked. Hardtack (galleta) was used instead, but only a few people could pay for it; there was no milk to be had, indispensable for the sick and for babies. The soldiers commenced to eat bread made of rice and rice boiled in water, which weakened them very much; and though they were not suffering actual hunger, everybody knew that calamity was not far off and was inevitable, for no provisions could be expected, either by land or sea.

Fortunately, the sailors of the ships and defenses, thanks to the foresight of the general commandant of the naval station, were still receiving full rations and had them for some time to come, thanks also to the interest taken in this matter by the Commandant of Marine.

The music continued to play at the Alameda and in the market place, but the people, who had nothing to eat, had no desire to go walking, and the market place and Alameda were deserted.

Horses and dogs were dying before our eyes. Carriages stopped going about for want of horses, which the scavenger carried off at night, and gradually the city acquired that stamp of sadness and absence of life which is seen in places into which cholera and plagues carry sorrow and death. The situation became more serious every day, and the discouragement was general, for every one knew that if the blockade should continue, the ruin of the city was imminent.

I must state that while the ships of the hostile fleet were firing on Punta Cabrera and Mazamorra on the 7th, 9th, and days following, insurgent bands, commanded by their principal chiefs, sustained a continued musket fire on land. In these attacks they were repulsed with great losses.

XX.—The Landing Expedition Appears.

June 16th.—Eighteen ships in sight.

At 5.45 the hostile fleet opened fire.

At 6.15 Punta Gorda commenced firing, but stopped shortly after.

The greater part of the projectiles dropped close to the Spanish fleet.

At 6.30 the fire became more intense.

At 6.35 smoke was seen for a few minutes issuing from the Infanta Maria Teresa. It was learned afterwards that a fragment of shell had caused a slight injury in the starboard gallery.

At 6.40 Punta Gorda again opened fire; ten shots.

At 7 the firing ceased.

At 7.15 the Furor and Plutón, which had their steam up during the firing, went alongside the steamer Méjico.

It was reported from the Morro that the ships which had been firing were eight in number; that the fire had been directed against the castle and the Socapa, both of them answering; that at the Morro battery a gunner had been killed and an officer and five soldiers (all belonging to the artillery) wounded; that at the Socapa two sailors had been killed and four sailors and Ensign Bruquetas wounded, the latter for the second time; and that one of the Hontoria guns had been put out of action by débris obstructing it, but that the enemy had not succeeded in dismounting a single gun.

At 11.45 the four sailors who had been wounded at the Socapa arrived in a boat at the royal pier and were taken to the military hospital, one of them, who was seriously wounded, on a stretcher from the firemen's headquarters, the other three in carriages.

At 12 a second lieutenant and a gunner arrived from the Morro and were also taken to the hospital.

During the night the ships continued to illuminate the coast with their search-lights.

The débris was removed from the Hontoria gun, which was again made ready for firing.

17th.—At 5.30 steady gun fire commenced in the distance to the west. It was learned that one ship was firing on Punta Cabrera. A few minutes later another opened fire on the Socapa.

Thirteen ships in sight.

The ship firing on Punta Cabrera was also firing on Mazamorra.

At 7.30 the firing ceased.

There was nothing further of importance during the day and the following night.

18th.—Fourteen ships in sight at daybreak. The Iowa left and the Massachusetts, which had been absent for several days, took her place.

At 7.45 p. m. gun fire was heard.

It was learned that it was from the Socapa firing at a ship which had passed within a short distance and had answered. About 20 shots were exchanged.

19th.—Fifteen vessels in sight.

At 7 two battle-ships arrived from the south; total, 17.

At 2.30 p. m. General Linares went to the mouth of the harbor, returning at 7 p. m.

During the night the ships were again running their search-lights along the coast and the entrance of the harbor.

20th.—At daybreak there were 21 vessels in sight, 7 of them battle-ships.

The Oquendo changed her anchoring place and went farther to the north.

At 12 the Morro reported that 39 hostile vessels had arrived; shortly after 3 more came, so that, with the 21 that were already opposite the Morro, there was a total of 63.

At 12.05 a loud detonation was heard and a great deal of smoke was seen at the piers of Luz and San José; it came from the schooner Trafalgar, where a shell had exploded while being fired, killing a sailor of the steamer San Juan and wounding three of the Mortera, one of whom died a few minutes later. The schooner had to be run ashore to prevent her going down.

Orders were received for the formation of the fourth army corps, in command of General Linares, composed of the division of Santiago, which was already under his command, and the division of Manzanillo.

Another cable was stretched between the Socapa and Cay Smith, like the one stretched between Cay Smith and Punta Soldado, and twelve Bustamente torpedoes were planted, half of them between Cay Smith and the Merrimac, and the other six between the latter and Punta Soldado.

21st.—It was learned that the 42 vessels that had arrived the previous day had proceeded in an easterly direction during the night, leaving only the former 21, most of them warships.

At 2.30 p. m. the Morro stated that the 42 vessels were again returning from the south.

The cruiser Reina Mercedes left her anchoring place at the Socapa and cast anchor in the bay, west of the captaincy of the port.

On the 16th the American fleet had again opened fire on the batteries at the mouth of the harbor, and although it could not be compared with that of the 6th, either in intensity or duration, yet it had caused us two deaths at the Socapa, and two officers and several sailors and soldiers had been wounded there and at the Morro. A 32-cm. shell, which exploded at the former of said batteries, raised such a quantity of earth that it partly buried one of the Hontoria guns, making it useless for the time being, and came near burying also the men serving it. During the night the earth covering the gun was removed, so that it was again ready for service.

The names of the Morro and Socapa have been repeated many times, and it has been shown that these two poor batteries were the main objective of the hostile fleet and had to withstand the fire of over 90 guns, most of them of large caliber, which they always answered; yet, I cannot help but speak once more of the heroism, truly worthy of admiration, displayed by those who served them, constantly exposing their lives and having to watch after fighting, without a moment's rest or sleep; for the enemy was always on the lookout for the least remission in watchfulness in order to surprise them and attempt a coup de main on the harbor.

Each one of them, and the governor of the castle first of all, earned the gratitude of the country every day for two months. Their self-denial and valor kept a powerful fleet in check for seventy days. The resistance which the Morro and the Socapa offered under the prevailing circumstances is a true feat of heroism.

On the 17th the ships reconnoitered along Punta Cabrera and Mazamorra, firing on the detachments of the Asiatic column.

On the 20th, the day when the 42 vessels of the convoy appeared with the landing expedition, a shell exploded in the hold of the schooner Trafalgar, causing several deaths and injuring the hull of the schooner, which had to be run ashore in order to prevent her from sinking.

I shall not speak at length of a matter which is of no importance, but will mention it briefly, because it gives an idea of the craze reigning at Santiago, to which the frequent bombardments, which must have cost at least a million dollars, gave rise.

Whether by reason of the type of their fuzes, or because many of the shells did not have the requisite powder charge (I have discharged a 57-mm. shell myself, which had only one-eighth of it), certain it is that many did not explode and remained intact as though they had not been discharged; as they were being thrown in such large numbers, many people wanted to keep one as a curiosity or as a souvenir of an event which does not happen often in a lifetime. Some wanted them of small, others of large caliber; others wanted to make a collection of all sizes. I have a friend who called on me one evening to show me a 20-cm. shell which had been discharged and had not suffered the least deformation. The fad had cost him 20 pesos, and he was as happy over it as a child over a new toy. But I was thoughtless enough to tell him that there were 32-cm. ones, and he was inconsolable. It will be understood from the above that the fad was being paid for dearly; and as capital is always made out of everything, many people made a business of gathering up and discharging projectiles and selling them. That was the cause of the unfortunate occurrence on board the Trafalgar; a shell had been discharged without the necessary care, and what happened was but the natural consequence.

Another monomania of this period: As the Americans kept up the bombardments all through the month of June, so that there hardly was a day when gunshots were not heard at a greater or less distance, people were hearing them all the time; the falling of a chair, the closing of a door or window, the noise of carriage wheels in the distance, the crying of a child—everything was taken for gunshots, and gunshots was all that was being talked about. When they finally ceased, Santiago had become so identified with them that people almost missed them and were surprised to hear them no longer.

XXI.—Line of Observation.

We have now reached a period when the events acquire the greatest interest and assume exceptional importance. So far it was only the fleet that had been antagonizing us; and numerous and powerful though it was, it had threatened only one point, which experience showed us it did not dare attack or force. Henceforth we shall find ourselves menaced also on land by an army equipped with numerous modern artillery, which, supported by the ships that had control of the sea and could therefore, without trouble, communicate with their dépots and base of operations, and further supported by the insurgents who had control of the field, was constantly receiving reënforcements of men and material and had at its disposal everything which we, unfortunately, were lacking.

From this time on the events are precipitated, so to speak, and lead with dizzy rapidity to a dénouement which it is not difficult to foresee. In view of the exceptional location of the island of Cuba, we can not hope for help either from within or without; we can not hope for provisions nor ammunition, and without these the soldier can not be fed and can not fight—a sad and desperate situation for men who ask for nothing else and whom fate seems to pursue.

When speaking of military operations and movements of troops, it is not always possible to give a full account of them as they happen; there is danger that some of the occurrences, the situation of the forces, and the points they defend or attack, may not be known. In order to obviate this, and to give the reader a better understanding of the events that took place later, I will give an outline, though perhaps incomplete, of the distribution which General Linares made of the forces he had at his disposal.

It has already been stated that on the 20th the Fourth Army Corps was organized, consisting of the Santiago division and the Manzanillo division. General Linares was made commander in chief, and Lieutenant Colonel Ventura Fontán, who had been chief of staff of the latter division, retained the same position relative to the corps.

General Toral, though in command of the division of Santiago, remained at the head of the military government of the city, with the same chief of staff. It may, therefore, be said that nothing was changed.

From telegrams received, the enemy's plans could be, if not accurately known, at least surmised, and as it was supposed that they might effect a landing at a point on the coast more or less close to the city, General Linares ordered the concentration of his forces so that they might be assigned to convenient positions. First of all, orders were sent from Havana to Manzanillo, by telegraph, for General Escario to proceed with all the forces available, and with the least possible delay, to Santiago de Cuba. Said general left Manzanillo on the 22d with 3,300 infantry, 250 cavalry, two Plasencia guns and 60 transport mules. The infantry was composed of the battalions of Alcántara, Andalusia, Puerto Rico chasseurs and two battalions of the Isabel la Católica regiment. These 3,300 men who, from the time they left Manzanillo, had encounters every day with the insurgents, who killed and wounded 97 of them, could not arrive here, in spite of forced marches, until the evening of July 3; this should not be lost sight of.

At another place I have spoken of the scarcity of provisions in the city. The authorities, in order not to diminish the chances of assistance which they might obtain from the region under cultivation, for the men as well as the horses and mules, combined the operations and position of the troops with the object of attempting to preserve that region and looking out for the enemy in all directions.

With this object in view, a line of observation was established, as follows: To the north, from Palma Soriano through San Luis, El Cristo, and Socorro; to the west, from Punta Cabrera through Monta Real and El Cobre, on the roads which lead to the city on that side, and to the east, from Daiquiri through Vinent and Firmeza to the harbor of Escandell.

On the 22d the first companies of the Spanish fleet disembarked, with a force of about 130 men each, under orders of the third commanders of the ships respectively; two companies were stationed at San Miguel de Paradas, to guard the coast west of the bay and assist the Socapa or the city; the third company at the Socapa, to reënforce that point, and the fourth and last company at Las Cruces, to assist the Morro, Aguadores, or the city.

At night of the same day, the second companies disembarked, including men from the Mercedes and the destroyers, a total of 450, who, under command of Capt. Joaquín Bustamente, went the following day to occupy the line from Dos Caminos del Cobre to the Plaza de Toros; that is, south and southwest of the precinct.

The only forces in the Santiago district prior to the declaration of the present war were nine companies of mobilized troops and two of the Santiago Regiment, to garrison the city and the forts of the precinct, besides a small number of the Civil Guard and a few artillerymen, and as much cavalry as was indispensable for convoy and other services properly belonging to the cavalry.

When war was declared, six more companies of the Santiago regiment came for the purpose of commencing the fortification works of the precinct of the city, under the directions of the chiefs and officers of the corps of engineers; another company was occupying the position of Ermitaño (east of the city) and another was at Socorro.

I believe I have already stated that by orders of General Linares the Talavera battalion had come from Baracoa and was stationed, with three companies of mobilized troops, along the coast to watch the same, occupying Daiquiri, Siboney, the railroads, and the forts.

The Asiatic battalion, in command of Colonel Aldea, took up its position of observation west of Santiago: Four companies, with the colonel at Punta Cabrera, covering the coast road; another, with one mobilized company, occupying Mazamorra, both to be ready to reënforce the former four or the forces at the Socapa, if necessary, and to prevent in due time a landing at Cabañas; another occupied the camp at Monte Real, and finally another, with one mobilized company, garrisoned El Cobre. With these forces all the roads leading to Santiago from the west had to be covered.

Gradually, as information was being received concerning the enemy's plans, the available forces of the San Luis brigade, in command of General Vara del Rey, were concentrated in the district.

First, four companies of the Provincial Battalion of Puerto Rico (No. 1) arrived, one company remaining at El Cristo and one at Songo, both of them occupying also the forts on the railroad of both towns. Later came three companies of the San Fernando battalion, one remaining at El Cristo and two at Palma Soriano. Finally, General Vara del Rey, with three companies of the twenty-ninth regiment (Constitucion), one company of guerrillas on foot, and two Plasencia guns, occupied El Caney, where there were only 40 men of the Santiago regiment and 50 of the mobilized troops, leaving three companies of the twenty-ninth regiment at the towns of San Luis, Dos Caminos, and Morón. Two squads of cavalry were distributed in said three towns.

It is only necessary to cast a glance at the chart, without much study, to understand that the line which our troops occupied was too extensive to be solidly covered and effectively defended by such small forces.

Why did General Linares not limit it and occupy positions closer to the precinct and more susceptible of effective defense? For a reason which outweighs all others. He could not do so without condemning its defenders from the outset to an inevitable disaster.

I will repeat once more—for to this must be attributed the reverses we suffered—that there was nothing left in Santiago except rice, and only 500,000 extra cartridges outside of the regular supply of the soldiers, namely, 150 each; for although there were many more included in the surrender of the Park, they are of the Remington, Argentine Mauser, and other types, and of calibers differing from those of the Spanish Mauser, which is the weapon carried by almost all of our forces. Of course, 150 cartridges are used up very rapidly. It was the scarcity of provisions, confined almost entirely to rice, which, more than anything else, compelled General Linares to defend the line which, beginning at Ermitaño and passing through El Caney, San Miguel de Lajas, Quintero Hill and the hills of La Caridad and Veguita, would protect the railway to Sabanilla and Morón and the aqueduct. If the troops could have maintained this line, they would not have suffered for lack of water, as they did in some positions, nor would the food, as long as we remained in possession of the cultivated region, have been reduced to rice bread and rice boiled in water, which the soldiers could not stand and which made them unfit for the active operations necessary in war.

The Morro and the Socapa had to be not only occupied, but well protected; they were the key to the harbor. If the enemy had taken possession of them, it would have been easy to remove the torpedoes and force the bay, and then the city and its defenders would necessarily have had to surrender.

It was equally necessary to occupy Daiquiri, Siboney, and Aguadores, so as not to allow the enemy to make a landing at any of them with impunity (as they did after all, supported by the warships, at the first-named place) and gain possession of the railroad. For the same reasons also, it was necessary to cover the landing places of Cabañas and Guaicabón (near Punta Cabrera), as also the west coast of the bay, and preserve the railroads leading to the city.

All this proves that it was not only desirable, but absolutely necessary to defend said line. To give it up would have meant to be resigned from the outset to perish from hunger, and perhaps from thirst, which is worse.

If El Caney and the San Juan position had not been taken we should not have lost our communications with the cultivated region, nor would the aqueduct have been cut, and it is easy enough to understand how much these two things had to do with later events, and how different the situation would have been without them. Unfortunately the small number of our forces made it impossible to save these positions.

The ships would no doubt have reduced the city to ashes and ruin, but there would have been water and more provisions, and the army would have been able to maintain itself and fight, at least until the last cartridge was gone.

Unfortunately the insurgents, firing from ambush, as usual, on General (then Colonel) Escario's column, succeeded in delaying its march long enough so that it could not arrive before the 1st of July. Fate is not always just.

XXII.—Events of June 22d to 27th.

The reader being acquainted with the number of our troops, the positions they occupied and the sites they covered and their object, it will not be difficult to understand and appreciate the operations carried on and the events taking place here.

On the evening of the 21st it was learned, as has been stated, that the enemy was effecting a landing at Punta Berracos.

June 22d.—At 6.30, the usual ships were opposite the mouth of the harbor; in Aguadores Bay there were two yachts and one monitor; at Punta Berracos, the 42 vessels of the convoy, among them the Saint Louis, with the Indiana. A steamer, with tugs, could also be seen. We therefore knew that the landing was being effected. We also saw the house on fire that the English had on San Juan river.

At 8 the enemy opened fire and Punta Gorda answered.

At the same time, one ship fired upon Aguadores.

The Brooklyn, Iowa, and Texas were firing on the Morro and Socapa, and the batteries were answering.

At noon the firing ceased in the mouth of the harbor.

Punta Gorda only fired five shots.

The firing continued on the coast toward the east.

During the day the first companies of the Spanish fleet (4 companies, about 520 men) disembarked. At midnight the second companies (about 450 men) disembarked. It has already been stated what part of the ground they were to cover.

At 11 o'clock p. m. two shots were heard and a loud detonation, followed by a noise resembling that of a screw revolving in the air. Shortly after, another similar detonation was heard.

23d.—Opposite the Morro entrance, and at a distance of about 6 miles from it, 8 battle-ships, 2 destroyers, the Vesuvius, and 8 merchant vessels. The rest, as many as 63, continued the landing on the coast, protected by some of the warships.

At 2.30 a yacht, with a white flag, left the fleet and approached the Morro. The tug Colón went out to speak with her. At this time there were 24 ships opposite the harbor.

During the night the enemy examined the coast again by means of search-lights.

24th.—Eight battle-ships, 2 destroyers, the Vesuvius (which, at 11 o'clock on the previous night, had thrown two dynamite bombs on the port, fortunately without doing any harm) and 12 merchant vessels, are guarding the mouth of the harbor, stretched out from Aguadores to Punta Cabrera. The others, as many as 63, among them six warships protecting them, continued the landing at Daiquiri.

The yacht that came up yesterday with a flag of truce was sent by Admiral Sampson, who inquired whether the lieutenant who had been made prisoner was being kept in the Morro. Mr. Concas, who was delegated to parley, answered evasively, as was natural, that the prisoner was in a safe place.

At 11.55 the Brooklyn opened a slow fire on Daiquiri and adjoining points on the coast.

At 1.30 the firing ceased.

At 1.55 it was again heard in the same direction, ceasing at 2.30.

At night the hostile fleet used the projectors again.

25th.—At 4 a. m. 14 shots were heard in the direction of Daiquiri. It was presumed that they were firing on General Rubin's column.

At daybreak there were at the mouth of the harbor 8 battle-ships and 12 merchant vessels.

From 12.30 to 2 o'clock the hostile fleet kept up a slow fire on the coast from Aguadores to Daiquiri.

It was noticed that the vessels landing troops or material were going back and forth, so we felt sure that new reënforcements were constantly arriving from the United States.

26th.—At daybreak the New York, Brooklyn, Indiana, Oregon, Massachusetts, Texas, Vesuvius, 1 monitor, and 6 merchant vessels were in front of the harbor. To the east, in the direction of Berracos, 11 steamers could be seen, and 8 at Daiquiri, inside of the roadstead.

The Vesuvius had discharged two bombs the preceding night, one completely destroying the house of the lighthouse keeper, the other seriously damaging the fortress, wounding three sailors of the Mercedes and a soldier of the garrison.

27th.—The same ships blockading the harbor as the preceding day.

During the night the Vesuvius threw 3 dynamite bombs, doing no damage, as they fell in the water, although inside of the harbor.

The search-lights were going again during the night.

On the evening of the 21st the enemy had commenced to effect the disembarkation of the landing expedition (which according to New York newspapers consisted of 50,000 men), and in order to do so in perfect security, even though they had in all 63 vessels, counting both merchant and warships, they landed them at Punta Berracos, 20 miles from Santiago, in spite of there being no water and no roads, because our troops, few in number, could not cover such an extensive region.

To assist the landing, the ships were firing on the whole coast from Berracos, east of Santiago, to Punta Cabrera, 27 miles west. How could we cover so many threatened points and occupy so extensive a territory? Impossible, even if we had had much superior forces than we did.

The battle-ships, always in imposing numbers, remained in front of the harbor so as to keep our fleet in. The warships were protecting the landing, and as they controlled the sea it was impossible for soldiers with small arms to prevent it.

How many men did the Americans disembark?

As Santiago was cut off from the rest of the world, or almost so, it was not easy to ascertain the exact number, nor was it necessary. The vessels of the convoy, as soon as they had landed men and material, returned to the United States and came back with fresh contingents. But it may be safely stated that the first expedition consisted of at least 15,000 men, with more or less war material.

I base this estimate on the fact that forty-three vessels arrived, including six warships apparently convoying them, and although the latter can, and generally do transport troops, I do not count them, nor do I count five small tugs; hence there remain thirty-two of all sizes, and modern steamers can surely carry on an average not less than 1,000 men each, especially in view of the short distance from Key West to Santiago and the fine weather prevailing. But taking into consideration the circumstance that they had to carry war material as well, I will reduce the figure to one-half, namely, 500 men to each steamer, and there would still be 16,000. There can be no doubt, as everybody will admit, that, if I err in my calculation, my figures are below rather than above the actual number. Moreover, as I have said, this matter is not of great importance, for new contingents kept constantly arriving, and the Americans also knew that the insurgents, who were awaiting their arrival, would swell their forces.

Every night, with great regularity (between 11 and 2), the Vesuvius threw her three dynamite bombs on the batteries at the mouth of the harbor, with the greatest humanity possible, for it will be remembered that such was the pretext of this war. For that purpose she would come close to the coast, accompanied by another ship, usually a battle-ship—for the mission of the Vesuvius is only the offensive, she has no defensive qualities—and as soon as she was within convenient distance she would discharge three tubes at regular intervals. If the projectiles dropped close to a battery its ruin was certain, for one must see the effects of one of these projectiles to understand them. Fortunately, they do not appear to be very sure; either in range or in aim.

On the sea, matters continued in the same condition. Let us now see the operations carried out on land by the Army forces during this period, the latter events taking place at diametrically opposed points.

On the 22d Daiquiri and Siboney were bombarded by the ships. At the same time the enemy appeared at the former place. As the force guarding it could not cope with the ships, it retreated by way of Vinnent to Firmeza, gathering up all the detachments from the forts.

General Rubín, with three companies of the provisional battalion of Puerto Rico, three of San Fernando, and two artillery guns (Plasencia), proceeded to Siboney. There he received orders to proceed with his column and with the whole force in the mineral region to the heights of Sevilla before daybreak, where they were to take position in three echelons, the foremost one under Commander Alcañiz, formed of the three companies of Puerto Rico and one mobilized company.

On the 23d this echelon alone checked the enemy's advance in the morning, and again in the evening, the echelon having been reënforced by one company from San Fernando, half engineers, and two guns. When the battle was over the forces withdrew to their former positions, the echelon remaining on the same site.

At daybreak on the 24th the echelon was reënforced by two companies from Talavera, and not only resisted a strong attack of the enemy, but also forced the latter to retreat.

In spite of this advantage they received orders to withdraw because the enemy was approaching the Morro by rail, and as there were not forces enough to oppose him, it would have been surrounded. In compliance with the order received the column withdrew to the city.

The official report of this battle is as follows:

"General Rubin's column, under orders of the commander-in-chief of the Fourth Army Corps, was attacked yesterday at noon and in the evening.

"This morning considerable forces with artillery guns made a resolute attack and were repulsed, losing many men.

"On our side we had in the two days seven dead, José Lancés, captain of the provisional battalion of Puerto Rico, and Zenón Borregón, second lieutenant of the same battalion, seriously wounded; Francisco las Tortas, first lieutenant of the regiment of Royal Artillery, slightly wounded; two privates seriously wounded, two slightly wounded. Various contusions."

Later on it was learned that the forces which attacked General

Rubín's column, or rather the echelon of the same, under Commander Alcañiz, were as follows:

The seventh, twelfth, and seventeenth regiments of United States infantry, the second Massachusetts, the seventy-first New York, and 16 dismounted squadrons.

On the 26th the following was published:

"General order of the Fourth Army Corps, dated June 26, at Santiago de Cuba:

"Soldiers: We left the mineral region because I did not wish to sacrifice your lives in vain in unequal battle, with musket fire, against the pompous superiority of the enemy, who was fighting us under cover of his armored ships, armed with the most modern and powerful guns.

"The enemy, rid of our presence at the points referred to, has already landed his troops and proposes to take the city of Santiago.

"The encounter is at hand and it will take place under equal conditions.

"Your military virtues and your valor are the best guarantee of success.

"Let us defend the right, ignored and trampled upon by the Americans, who have united themselves with the Cuban rebels.

"The nation and the army look to us.

"More than a thousand sailors, disembarked from the fleet, will assist us. Volunteers and firemen will take part in the task of repulsing and defeating the enemies of Spain.

"The other division of this army corps is hastening toward us to reënforce us.

"I make no recommendations, because I feel sure that all will vie in the defense of their posts with firmness and resolve; but I will say that those assigned to any position, be it in the precincts of the city or at the foremost points, must stand firm at any cost, without vacillating, without thinking of retreating, but only of saving the honor of our arms.

"I shall comply with my duties, and, in conclusion, I say with all, Long live Spain!

"LINARES.

"The foregoing was published to-day, by order of His Excellency, for the information of all.

"VENTURA FONTÁN,
"*Lieutenant Colonel, chief of staff.*"

In order to convey a better understanding of the foregoing operations of General Rubín's column, I will give below a copy of the instructions and orders which said general received from General Linares, all of which were drawn up in camp and written with lead pencil.

They are as follows:

"Pozo, June 23, 1898.

"Civilians have handed to me the paper which you wrote to me, and we have heard firing since a quarter to five, and afterwards gun fire.

"I have impressed upon Colonel Borry to guard well the path or road to the Redonda, where he is encamped, so that the troops of the line, if they should find Sardinero occupied, can take that road to the Redonda.

"I have sent to Santiago for all the transport mules and ten carts, which will be at your camp by 7.30 or 8 o'clock. You will have the sick ready, and also the ammunition, so that they may at once be taken to Santiago, with the same convoy that will go with the mules.

"Make arrangements to have the first mess of the morning taken there and then you will receive further orders.

"LINARES.

"TO GENERAL ANTERO RUBÍN."

(Seal: "Army of Operations of Santiago—4th Army Corps—General Staff.")

"After eating the first mess you will march with the whole column to Santiago, effecting a retreat from that point by echelons as carefully and slowly as may be necessary, so as to be in good condition to repulse any attack of the enemy.

"The Talavera Battalion will go to Sueño and will there meet the chief of the town, who will indicate to it the points to be occupied.

"The Puerto Rico Battalion, with the two mobilized companies from the mineral region, will proceed to Cañadas and will there receive orders concerning the points it is to occupy, and the San Fernando Battalion is to proceed to Central Benéfico, and will also receive instructions. The section of artillery will go to the quarters at Dolores. The section of engineers will proceed to Cruces, taking quarters in the offices of the mineral company.

"LINARES.

"Pozo, June 24, 1898.

"NOTE: The captain of engineers is to return to Santiago with the convoy of sick and to report to Colonel Caula.

"TO GENERAL ANTERO DEL RUBÍN."

(Seal: "Army of Operations of Santiago—4th Army Corps—General Staff.")

"You have already received orders to retreat, which is to be done when the convoy of sick has started under the protection of two mobilized companies and one Talavera company.

"The whole train will retreat first, and upon arriving at Santiago, they will go to the points designated, and with the three echelons of Puerto Rico, San Fernando, and Talavera, you will make the retreat, alternating by echelons in such manner that when the forward echelon leaves a position the other two will be in position, until arriving at Santiago. There I shall await you.

"LINARES.

"TO GENERAL RUBÍN."

XXIII.—END OF THE MONTH OF JUNE.

June 28th.—The Morro said that the Massachusetts, which had been gone, had returned; that the Iowa had left instead, and that at 7 a. m. a merchant vessel was embarking the sick of the fleet, estimated at about 50, judging from what could be made out with the help of glasses; that to the east, at a distance, the ships were firing slowly.

During the night they continued to watch with search-lights.

29th.—The Iowa returned.

In the evening, firing on Daiquiri was heard.

30th.—The same ships are blockading the harbor.

The Morro said that at 3 p. m. a steamer was sighted to the south; that, when she saw the American fleet, she shaped her course eastward at full speed; that a yacht and a battle-ship went out to chase her; that the latter returned with the steamer which, with the American flag hoisted, joined the convoy at Daiquiri.

At 8 p. m. a few musket shots were heard in the direction of Campo de Marte (east of the city).

Later the sound came from the Plaza de Toros (northeast).

At 9 firing was again heard at the cemetery (to the north).

Nothing further occurred.

The last three days of the month of June are devoid of interest and we enjoyed unusual quiet. So much had the people of Santiago become accustomed to the sound of gunshots that they almost missed them.

But how true it is that when a calm comes after a storm, it is often only the precursor of another storm. The enemy was preparing to begin the month of July in a manner that Santiago de Cuba will remember many a day.

The hostile fleet continued to antagonize the coast as usual. But without neglecting their main objective and their constant care, that of watching our fleet, which, being short of provisions, would sooner or later be compelled to take some decisive action, they were gathering at the entrance of the harbor a large number of their most powerful ships, and the army, no doubt intrenching itself at Daiquiri, so as to have another shelter besides that of the ships, and a safe base of operations, was preparing to attack the city, supported by the insurgents who had joined them in large numbers under their leaders Calixto García, Demetrio Castillo, Cebrecos, and others less known.

This is proved by the musket fire which was heard a short distance from the city, to the northeast, on the night of the 30th.

From the news we had received from the Morro it might have been inferred that about 3 o'clock in the afternoon of that same day, the hostile fleet had captured a merchant vessel, which, after the American flag had been hoisted upon her, joined the convoy; but this is not probable. Aside from the fact that the flag of a ship is not changed as easily as that, the truth would have become known sooner or later. It is more probable that it was a vessel that was not expected and they went out to reconnoitre. That is my opinion about this incident, which, in reality, is not of much importance.

A few words more about the Vesuvius that gave us so much trouble for a few nights—that time, it seems, suiting her best to carry out her exploits. This ship is the only one of her class; her projectiles and the apparatus throwing them are not known, and she has made her début here. One of the projectiles which fell on the northern slope of the Socapa, tore up trees right and left for a distance of about 20 metres. From a certain distance, as I could see the day I went to the Mercedes, it looked as though a road had been opened across the mountain.

Another, which fell a short distance from the one just referred to, made an excavation, not very deep, but very wide; I was told that it would hold twenty horses. This would seem to indicate that the screw with which they are provided keeps on revolving even on solid ground.*

Still another dropped in the water, but close to one of the destroyers, which was violently shaken, as also the Mercedes, anchored at a short distance. I heard this from the commander of the former and the officers of the latter.

The forces of the army which, as has been stated, abandoned the mineral region, not being able to maintain it, concentrated in the city, preserving, as was indispensable, the line from Aguadores to Cruces, after destroying the bridge at the former point. The line (4 kilometers) was covered by six companies of the Santiago regiment and two of mobilized troops, a total contingent of about 800 men.

The advance post of Caney (a league and a half—about 6 miles —from the city), in command of General Vara del Rey, was defended by three companies of the battalion "Constitución" (the 29th), one company of guerrillas on foot, in all 430 men, 40 soldiers of the Santiago regiment and 50 of the mobilized troops, being a total of 520 men.

The line of the precinct (9 kilometers), extending from Dos Caminos del Cobre, west of the city, to the fort of Punta Blanca, to the east, on the seashore, was defended by the following forces:

Corps of sailors from the fleet (four second companies)	458
Four companies of the Provisional Battalion of Puerto Rico	450
Talavera Battalion, No. 4 (Peninsular)	850
Four companies of the San Fernando Battalion, No. 11	440
Total, army	2198
Three companies of mobilized troops	330
Volunteers	440
Total	2968

Also a small number of gunners, for there was not a sufficient number to serve the guns installed, the number and place of

* The reference to the "screw" in this paragraph probably refers to the vanes or feathers on the rear end of these shells. They are for the purpose of giving the shell rotation in its flight, and being fixed to the shell they have no independent motion.—O. N. I.

which has been mentioned. It may therefore be said that there were, in round numbers, 3,000 men.

This was the fighting force. Within the city was the cavalry force (for which the ground, being hilly and cut up by trenches, was not adapted), and a small force of the civil guard assigned to duty in the city, and the firemen with their engines in readiness.

This line is divided into sections in command of colonels.

Of the 3,000 men defending it, two companies, one of the Provisional Battalion of Puerto Rico and the other of the Talavera Battalion, defended the advance position at San Juan, one being assigned to the right, the other to the left side of the road.

Finally, at the Socapa, that is, at points in an opposite direction from that line, there were 400 men, 450 at the Morro, and 120 at Punta Gorda. It must be remembered that these three positions overlook the entrance of the harbor, and are its key, and must for that reason be maintained at any cost; and these forces were indispensable there, as the enemy might attack them, as indeed he did attack them the next day.

The same day, the 30th, the following telegram, addressed to the aid of marine (ayudante de marina) of that district, was received at the comandancia de marina from Manzanillo:

"COMMANDER MARINE, Santiago:

"Last evening, for about an hour, we sustained in the waters of this harbor a battle against three hostile vessels of medium tonnage, which passed, at a distance of about a mile from the head of the piers, in a northeasterly direction, under low steam.

"The following took part: Gunboats Guantánamo, Estrella, and Delgado-Parejo, under my command, and a group of vessels that were disabled, consisting of the pontoon Maria and gunboats Cuba Española and Guardián. With the former three we arrived in time at the other group, as the enemy passed by, who, finding himself attacked, stopped his progress only a short time on account of an injury which our vessels had inflicted on the second of theirs, which made it necessary for the third one to tow her to windward, and then, with slow speed, though keeping up a steady fire during the retreat, they doubled the headland northeast of the Manzanillo Cays, heading north, and soon disappeared from sight. The city co-operated efficiently with the few guns it has. We had two dead, two slightly wounded, and one bruised, on the Delgado-Parejo; two slightly wounded and two contusions on the other ships; in the city, a few wounded; injuries to all the ships, but not material.

"BARREDA."

XXIV.—BATTLES OF EL CANEY AND SAN JUAN.

July 1st.—At 7 gun and musket fire were being heard in the direction of the Plaza de Marte (east of the city).

According to the Morro the Minneapolis arrived to reënforce the hostile fleet.

At the comandancia de marina we could hear a slow gun and steady musket fire in the direction of Campo de Marte.

The enemy had a captive balloon, from which he observed our positions; from the Reina Mercedes headquarters (converted into a hospital) it could be plainly seen. It was in the direction of Sevilla.

The American fleet is firing from Aguadores, the greater part of the projectiles passing over the city. Others fall inside, some exploding and some not. Many have already fallen in the houses, among others a 20-cm. shell, which fell in the house of the chief pilot of the port, but did not explode. The ships firing from Aguadores are the New York and the Oregon.

The streets of the city are almost deserted; only soldiers and volunteers are seen as they go to their posts. As usual, many projectiles are falling in the bay near our fleet.

The firing from the ships ceased at 11.

At 2 intense musket fire was heard in the direction of El Caney; at 2.30 also gun fire.

By 3 o'clock the musket fire became steadier; constant volleys were being heard; at 4 it became less intense.

At 10 p. m. General Cervera left his ship, returning at 12.

On July 1st, at 6 a. m., the nucleus of the hostile army under command of General Shafter, and which must have consisted of at least 15,000 men, with many modern guns, without including the insurgent parties, attacked the lines of the precinct east and east-northeast of the city, that is El Caney, defended by General Vara del Rey with 520 men and two Plasencia guns, and the position of San Juan, occupied by two companies comprising 250 soldiers.

The attack which the Americans made with 12,000 men, as stated by themselves, was commanded by General Wheeler, second in command of the army.

A brigade of 3,500 men, also under the orders of said General Wheeler, and supported by another, directed its efforts upon El Caney, while Colonel Chaffee with 2,000 men attacked the hill and fort of San Juan.

The Americans, it must be acknowledged, fought that day with truly admirable courage and spirit. The houses of El Caney, which General Vara with his 520 men converted into as many fortresses, threw forth a hail of projectiles upon the enemy, while one company after another, without any protection, rushed with veritable fury upon the city. The first company having been decimated, another appeared, then a third, and still another, and those soldiers resembled moving statues (if I may be permitted that expression for want of a better) rather than men; but they met heroes, and although the houses had been riddled with bullets by the artillery and musketry, and although the streets were obstructed with dead and wounded, El Caney had been converted into a veritable volcano, vomiting forth lava and making it impossible to go near it.

Both sides being short of forces and out of breath, almost without having stirred from their relative positions, the battle ceased for some time, and General Vara del Rey took advantage of this circumstance to have his soldiers re-form the lines and again get ready for the battle.

General Linares, who was repulsing the attacks at the position of San Juan, upon learning the result of these assaults, warmly congratulated the handful of lions in these words: "When the American army attacked El Caney they had not counted on a general of Vara del Rey's stamp and on troops as fiery and inured to warfare as those he had under his command."

The fight commenced once more and the enemy attacked again and again, being always repulsed, but as we had no reserve forces, and the Americans, on the contrary, had a great many, the battle was no longer possible under these circumstances. The General was wounded almost simultaneously in both legs by two musket balls, and as he was being carried away on a stretcher, the bullets falling around him like hail, he was killed by a third one, at the same moment as two of the men who were carrying him.

The greater part of the commanders and officers (among them two relatives of the General) were dead or wounded, as also the majority of the soldiers. Finally, at 7 p. m., the commander being dead and those 520 men having been reduced to less than 100 and most of these slightly wounded and bruised, that handful of heroes, for want of forces and a commander, retreated from the site, which for ten hours they had been defending without being able to get any reënforcements, for there were none to be had, and the enemy occupied the position on which he, in his turn, had made such a bold attack.

Of the 520 defenders of El Caney only 80 returned, most of them crippled and bruised. The Americans acknowledged that they had 900 casualties.

As has been stated, 2,000 men under the command of Colonel Chaffee, well protected, attacked in the morning the position of San Juan with the same spirit and enthusiasm with which Wheeler's men made the attack on El Caney.

Our headquarters were situated in an excellent position, at the crossing of the roads to El Caney and Pozo. General Linares had no available reserves; he therefore formed the echelon close to the positions of San Juan where he could observe the movements of the enemy and assist personally at points where his presence might be necessary.

With him was General Ordoñez with two rapid-fire guns.

In the foremost echelon at San Juan was Colonel José Baquero, of the Simancas regiment of infantry, who had come from Guantánamo with a message, and could not return on account of the blockade. This echelon was two companies strong, and before the Americans opened fire, it was reënforced by another company. It is here that Colonel Ordoñez was, with the rapid-fire division; the position being defended by 300 infantry and two guns.

The echelon nearest San Juan consisted of three companies of Talavera, one company with General Linares to the right of the Pozo road, forming an angle, in order to prevent a surrounding movement on the part of the enemy from the right of San Juan; another at the angle of the two roads referred to, and a third at Veguita toward El Caney, crossing their fire with that of the forces at Sueño.

In view of the small numbers of our forces and the ever increasing numbers of those of the Americans and their war material, we reënforced our positions by some trenches, under shelter of which we might be able to prolong the fight for a longer time.

The cavalry formed the third line at the fort of Canosa, protected by a small hill.

After the cannonade of the morning, in which our guns with accurate aim succeeded in causing the enemy many casualties and silencing the fire of one of his batteries erected at Pozo, and when the Americans had brought together considerable forces of infantry, they attacked about noon with cannon, machine-gun, and musket fire.

The situation of the line commanded by Baquero was critical. Colonel Ordoñez and the commander of the Puerto Rico battalion, Mr. Lamadrid, had been wounded. One-half of the officers had also fallen under the action of the lead that was pouring down upon the line. The enemy was advancing in large and compact masses, firmly resolved to take the positions, but Baquero, the brave soldier, who had distinguished himself so highly in the campaign, was there, keeping up by his example the spirit of the troops, almost annihilated by hunger and fatigue, and decimated by the clouds of bullets and grapeshot.

At this critical moment the cavalry was ordered to advance rapidly in order to protect the retreat of Colonel Baquero's forces and save the artillery if possible. Lieutenant Colonel Sierra hastened to carry out the order, as Commander Arraiz had done before him at San Juan.

The line which General Linares commanded personally now formed the vanguard. With his assistance the General's aids and his chief of staff had to organize the remnants of the first line.

It was necessary to maintain that position at any cost, for its loss would give the enemy free entrance into the city. The brave men of the first line were retreating. Colonel Baquero had disappeared, killed, no doubt, when he led that retreat under the hail of grapeshot and lead. The enemy was advancing in compact masses, and rushing upon what was now the first line. Fortunately the fire of our infantry, accurately aimed, compelled the Americans to recede, and they retreated behind the positions of San Juan. At that moment General Linares and the brave commander of infantry, Arraiz, fell wounded; the latter officer, who had already shed his blood at Cacarajícara, was one of the most beautiful examples of the army.

While these cruel battles of El Caney and San Juan were carried on the enemy sent forces against our whole line, for the purpose, no doubt, of harassing us and making the attack more general.

The San Juan forces tried once more to recover themselves. Others came to their assistance, among them the company of marines which had been stationed at the Plaza de Toros with Captain Bustamente; but the enemy was already strongly occupying the position, our forces were scant, and success was impossible. Our artillery was steadily firing at many points of the line, loading the guns (old ones, as has been stated) without any protection, but the fire was extremely slow and therefore of little efficacy.

At 3.30 p. m. I went toward the Campo de Marte, impatient to learn what had happened. At the Plaza Dolores I met General Linares. His arm, which had been seriously wounded in the first trenches, as stated, had been dressed at the military hospital and he was now being taken to his house on a stretcher, escorted by a few horsemen.

When I arrived at the end of Enramadas street and was only a few feet from a trench of the third line, covered by a section of volunteers, I saw a part of the battlefield. The musket fire was very slow, and although Santa Ursula fort, situated to the right and somewhat in the rear of the trenches referred to, was firing as rapidly as its muzzle-loading guns permitted, it will be easily understood that there was no new attack that day.

I then went to the headquarters of the cavalry, at the entrance of El Caney road, where a section of the cavalrymen were ready to hasten wherever they might be ordered.

It may be said that the battle was at an end and many commanders and officers were arriving, all tired out and almost dying from thirst. Among others, I saw Commander Irlés, of the general staff, who had had either one or two horses killed under him, and there I learned that the number of commanders and officers wounded had been comparatively very large. Mr. Molina, lieutenant colonel of the civil guard, arrived and said that Commander Bustamente of the navy had been seriously wounded and was being carried on a stretcher. My consternation may be imagined. I hurried out to meet him and found him a few minutes later. In spite of the heat, he had been wearing his blue-cloth suit in the fight, by which he could be easily distinguished from all others. He was covered with blood, pale and disfigured, his eyes closed, and without his saber and revolver. I learned that before he was wounded his horse was killed under him and his hat shot through. I accompanied him to the military hospital. In spite of his insignias of a commander, nobody paid much attention to him. This can be readily understood, for that day, in a short time, over 300 wounded had been received, and they were still coming. It was difficult to find beds and the attendant personnel, although increasing, was not sufficient to look after all.

I succeeded in finding Antonio Cañaz, the surgeon of marine, whom I know, and in whom I have unlimited confidence, and thanks to him, the wounded man was placed on a bed and his clothes taken off. They had to be cut with scissors. The wound was in the right side of the abdomen; his legs were covered with blood. The position of the bullet, the aspect of the wounded man, and above all the look with which Dr. Cañaz answered mine, left me no doubt. I knew that he had only a few moments to live and I left the hospital deeply affected.

I will add that, as the hospital was situated in the sector attacked by the enemy and near the trenches, being outside the city, musket balls were falling in great quantities in the court and on the roof; later on, shells were flying over it in all directions.

As has been seen, two battle-ships from Aguadores were throwing projectiles upon the city and the bay, causing victims among the inhabitants and damages to the buildings. As I went to the captaincy of the port in the morning when the firing commenced, I saw at the ambulance improvised at the Bottino pharmacy, a woman who was having her head dressed, which had been struck by a fragment of shell. The wound, although not deep, was wide, and looked as though made with a razor.

At nightfall the firing ceased along the whole line.

Such were the battles of that day, so serious by reason of the blood that had been shed, as well as by their results.

With the loss of El Caney, we lost the line which it had been so imperative for us to keep, and also the aqueduct and the region under cultivation—that is, provisions and water. We had to confine ourselves to the defense of the precinct, knowing full well that, though the sad end might be held off for a day or two longer, there was no possibility of avoiding it.

Our casualties were as follows:

Killed: Brigadier General Joaquin Vara del Rey, 3 commanders, 12 officers, and 78 men.

Missing: Colonel of Infantry José Baquero, 4 officers, and 116 men. The colonel was probably killed, but this could not be verified.

Prisoners: Two officers.

Wounded: Lieutenant General Arsenio Linares Pombo, 6 commanders, 30 officers, and 339 men.

(Among the wounded officers was Colonel of Engineers Caula and Colonel of Artillery Ordoñez.)

TOTAL CASUALTIES.

Generals	2
Commanders	10
Officers	48
Men	533
Total	593

Almost one-fifth of the combatants covering the whole line, and the whole line was not even attacked, but only a sector of it; consequently not all of them fought.

The casualties of the enemy, as acknowledged by themselves, were:

In the attack on El Caney	900
In the attack on San Juan	432
At other points of attack	328
Total	1760*

In these cruel battles the army inspired the enemy with respect and true admiration, perhaps because he had supposed that they fought in the same manner as the insurgents. The foregoing is my firm conviction, because I have seen and observed the events which I narrate and have dwelt much upon them.

On the 1st day of July the Americans fought, as I have stated,

* This is the figure of the original Spanish, but is probably intended for 1660.—O. N. I.

without protection and with truly admirable courage, but they did not fight again as they did that day. They entrenched themselves and set up their artillery as fast as they received it, and did not again come out from behind their fortifications. Did they think on that first day that all they had to do was to attack our soldiers en masse to put them to flight? God knows.

It was difficult to convince them that only 520 men had been defending El Caney for ten hours. When doubt was no longer possible their admiration had no limits. When they entered Santiago de Cuba, the American soldiers and ours looked upon each other without any prejudice or jealousy, perhaps because they knew that both had fought like brave men, and whenever the Americans saw one of our men of the twenty-ninth (the number of the battalion "Constitución," which had defended the city, and has been referred to so many times) they would call him, look at him, and treat him with great admiration, wondering perhaps, how so simple a soldier could do such great things.

The men of the twenty-ninth, known to have done something worth doing, were loved and feasted by every one and spent whole hours with the Americans, who did not understand them, but applauded everything they said, on the assumption, perhaps, that he who is brave must also be bright.

Incidents like these I saw, not once, but a hundred times, and they have made me believe and say what I have stated. I may be mistaken, but I do not believe it, because I have also noticed that the Yankees treat the insurgents, although they are their allies, very differently. Besides, I am only citing facts, and any one can construe them to his own satisfaction.

From the foregoing, it is reasonable to believe that when 520 men maintained themselves at El Caney for ten hours, and 250 at San Juan for four hours, if Escario could have been there that day, so that there had been 3,000 men more in our lines, neither El Caney nor San Juan would have been lost, though attacked by almost the whole hostile army.

General Linares surrendered the command to General Toral.

In the battle of July 1, General Rubín, who commanded the forces of San Juan and Portillo del Caney, had his horse killed under him at the latter place at 5 o'clock p. m.

XXV.—Actions of the 2d and 3d.

July 2d.—At 5 o'clock gun and musket fire commenced, well sustained in the direction of the land.

At 6 the hostile fleet opened fire on the Morro and the Socapa. The greater part of the projectiles fell in the bay and on our fleet.

The firing ceased at 8.30.

Punta Gorda, which also opened fire, discharged 8 shots.

The musket fire was intense.

At 8.15 Punta Gorda again opened fire. At the same time the Plutón started up toward the mouth of the harbor. The musket fire ceased.

At 9.30 the military governor said by telephone: "I ask your excellency to send a boat, so that by going as close to the coast as possible, the enemy may be checked at San Antonio and Plaza de Toros." At this time the enemy opened musket fire in the same direction. It ceased shortly after.

The companies of the fleet embarked again. A pilot was sent to each one of the ships.

The body of sailors that disembarked was protected in a line of trenches by Colonel Aldea's column (Asiatic battalion), which withdrew from the coast to the city.

At 8 o'clock four wounded from the Socapa were brought to the pier. A shell which exploded on one of the guns killed three men and wounded six, completely disabling the mount of the Hontoria gun, which could no longer be used. Among the wounded was Ensign Fernandez Piña, who was in command of the battery.

At 1.30 a slow gun fire was heard in the distance.

The French consul, on horseback, with a flag of his nation on a very long pole, left for Cuabitas, followed by many people.

During the firing several projectiles of all calibers fell on the city.

At 3.15 musket and gun fire was being heard in the direction of Campo de Marte. The line of fire was very extensive and the musket fire intense.

At 4 o'clock the musket fire ceased, only the gun fire being heard now.

At 4.40 musket fire was again opened; volleys could be heard at intervals.

At 6 the firing ceased.

At 7 musket fire broke out again; ceasing at 7.30.

At 8.30 two blazes could be seen at the top of Monte Real to the west.

At 9.45 the enemy opened a violent musket and gun fire from the Plaza de Toros to the Campo de Marte (from east to east-northeast). To the left (Plaza de Toros) frequent volleys could be heard.

At 10.30 the musket and gun fire ceased.

The night was extremely dark. From 10 to 11.30 the ships of our fleet spoke by means of the ardois (light signals).

The enemy, during the night of the battle of Caney, and after burying the dead, not without paying due honors to General Vara del Rey, commenced work on the trenches, which they never left again, continued to surround our lines with the new reënforcements constantly arriving, and installed modern artillery and machine guns on the heights. The insurgents were covering Cuabitas and adjoining points, although in second line. We were decidedly surrounded and all our communications by land cut off, as they had been by sea for over a month and a half. Each hour that elapsed the enemy fortified the circle that inclosed us.

During the night the enemy kept up most incessantly a violent musket and terrific gun fire which we hardly answered, so as not to waste the little ammunition that we had left, which was, no doubt, what the enemy intended.

The Asiatic column (Colonel Aldea) arrived from the coast and occupied in line the post vacated by the companies of the fleet, situated on the road to Caney (in the entrance).

In the meantime the fleet was once more bombarding the Morro and the Socapa, where, after killing several men, they finally succeeded in dismounting one of the two Hontoria guns, which they had been constantly antagonizing since the 18th of May. At the same time they were bombarding the city from Aguadores, wounding several persons and ruining several houses.

The cruiser Reina Mercedes changed her anchoring place and remained at the head of the bay as much as possible, awaiting orders to open fire on Quintero Hill to check the enemy if he should appear there.

The French consul was the first to leave the city, which was abandoned by almost the whole population a few days later.

A little before 10 a. m. the enemy, who no doubt intended to surprise us, furiously attacked our lines, and was repulsed with great loss.

The events of the second of July may be summed up as follows:

Lively bombardment by sea and land, killing several men and disabling one of the only two guns with which we could attack the enemy from the mouth of the harbor; bombarding with impunity the defenseless city; a battle from trenches, the fire of which we hardly answered, and finally a night surprise that resulted in failure.

The companies of the fleet embarked rapidly in spite of the prevailing conditions. A pilot was sent to each one of the ships, which latter took in their boats and steam launches and loosened the spring on their cables, and the gunboat Alvarado, which had come out of the slip and was afloat, raised at night the six Bustamente torpedoes that were obstructing the channel to the west. Everything indicated, without leaving room for doubt, that the fleet was about to go out; but when and how?

It occurred to me (and nobody could have dissuaded me from it) that a fleet from the Peninsula was on its way to Santiago; that it would pass in sight of the semaphore of Puerto Rico; that consequently Admiral Cervera would know, given the distance and the speed of the former and allowing for the difference in time, when it would reach Santiago; and when fire was opened on the enemy it would leave the mouth free, he would go out and the two fleets combined would defeat the enemy. I remembered everything I had read in newspapers about the purchase of ships, and the date when those building had been launched. Everything became clear to me. We had ships and they were coming. No doubt they were quite near, or perhaps only a few miles distant, but where had the ships come from? I do not know—from heaven, from earth, from the air, from nothing at all—I do not know. But everything appeared possible to me, except that our fleet should go out alone to fight the ships that were assembled at the Morro.

The aid of marine, Mr. Dario Leguinia, even more optimistic than I (and that is saying a great deal), could not rest a minute. I shall never forget how during that night of the 2d we were sitting on the doorsteps of the captaincy of the port, making calculations as to the number of ships that might arrive and the

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SKETCH OF THE POSITION OF BOTH ARMIES ON JULY 3.

probabilities of success that we could count on. Our ships communicating by means of the ardois were another proof of this. The event announced was near, and we were to see great things happening. At times we even thought we heard firing out there on the sea at a great distance and in a southeasterly direction. How much desire and imagination can do!

At 1 o'clock at night there was nothing special to be seen, and so, feeling sure that important events were to take place the following day, I retired, not without repeatedly impressing upon the seaman (cabo de matrícula) to notify me at once at the first movement of the fleet, or the first gunshot. It would not have been necessary. My impatience and anxiety would have taken care of that much better than the cabo.

The next day it was learned that the blazes we had seen on the Monte Real were from the burning of the forts and the heliograph, which the detachment there had abandoned to hasten to Santiago, in order not to be cut off and surrounded. During the march, which was full of hardships, it became necessary to kill a horse for food.

XXVI.—Sortie of the Fleet.

If I were to live a thousand years and a thousand centuries, never should I forget that 3d day of July, 1898, nor do I believe that Spain will ever forget it. The day dawned beautifully. One of those summer days when not the slightest breath of air stirs the leaves of the trees, when not the smallest cloud is visible in the skies; when not the slightest vapor fills the atmosphere, which was wonderfully transparent, so that the horizon could be observed at a great distance.

Nothing special was to be noticed among the ships of our fleet; motionless on the quiet waters of the bay that reflected their hulls, though inverted, with wonderful accuracy, they looked as though they ought not to leave an anchoring place where they could remain in such perfect safety.

It was 8.30. Feeling sure that the ships would not go out, and taking advantage of the chance of getting a horse, for the distance was great, I went to the military hospital to see Mr. Joaquin Bustamente, whom I found a different man, as the saying is. His voice was strong, his eyes bright, and his cheeks flushed. He moved with ease and did not appear to experience any difficulty in doing so. I was agreeably surprised.

Why does one remember things that are really not of great importance? Is it perhaps because they are connected with others that are? I cannot explain it. I only know that I remember, word for word, the conversation that took place between us. It was as follows:

"Is the fleet not going out?" he asked, without giving me a chance to say anything.

"Not just now, I believe, though it is ready to go out. Is it known when the other fleet will arrive?" I said.

"What other fleet?"

"The one that is supposed to come from Spain; they probably know at about what time it may be expected at the mouth of the harbor."

"Don't be simple." (I don't remember whether he called me simple, or innocent, or a fool.) "There is no other fleet; the ships are going out and that is all there is to it. I have a letter from Don Pascual (Admiral Cervera) in which he tells me so."

I remained thunderstruck. I could doubt no longer. I knew Admiral Cervera sufficiently well, as does everybody else, to know that he does not say, and still less write, what he does not intend to do.

"Do you think he will go out to-day?" I said.

"I thought he was going even now."

I could not answer. A gunshot which, judging from the direction, could only be from one of the two fleets, left me motionless.

Two or three minutes later a terrific cannonade commenced, such as I have never heard, nor will probably ever hear again, a cannonade more intense than that of June 6, a thing which I believed impossible, shaking the building, thundering through the air. I could not think coherently. I kept looking at Mr. Bustamente like an imbecile, and he looked at me and didn't say a word. I felt something that commenced at my feet and went up to my head, and my hair must have stood on end. Then suddenly, without taking leave, I went out, got on my horse and rode down the hill at break-neck speed, and I hardly understand how it was that I did not break my neck. I arrived at the captaincy of the port, where I found them all, from the commander of marine to the last clerk, with emotion painted on every face, and all looking in the direction of the mouth of the harbor, the mountains of which, that had been such a protection to us, and which now prevented us from seeing what was going on outside, we should have liked to grind to powder.

The noise caused by the gunshots which the mountains and valleys echoed was truly infernal and comparable to nothing. An idea may be gained of what it was when it is remembered that over 250 guns, most of them of large caliber and all breech-loading, were firing incessantly. The earth trembled, and very soon Punta Gorda, the Morro and the Socapa took part in the frightful concert, adding the thunder of their guns to the noise of those of the two fleets.

But the firing continued and that is what puzzled me. I thought, taking into account the number and class of hostile ships and of our own, that the catastrophe of the latter must necessarily take place in the very channel of the harbor, which is such a difficult one, even for ships of less length and draft than those which formed our fleet, under normal conditions; how much more, then, when sustaining a battle. A deviation, a change of course ahead of time, an injury to the rudder or the engine, even though slight and momentary, the least carelessness, in a word, might run a ship aground, and such a disaster would cause also the destruction of the other ships that were coming after and which would have collided with the first; the hostile ships might sink the first right there and then; for the same reasons, the disaster of the others becomes inevitable.

To my mind, the going out from Santiago harbor under the circumstances Admiral Cervera did, and as confirmed by the commanders of the ships of the fleet, constitutes the greatest act of valor imaginable, for it meant to go out to certain death, not only with fearlessness, but with a clear head, for a man must be completely master of himself in order to command a ship without becoming excited nor losing his head. One may form an idea of it from the horror which I experienced, who was not in any of the ships, but I knew perfectly well the dangers of the enterprise, which, in my opinion, was impossible.

The day, as I said, was most beautiful and the calm perfect. Therefore, the smoke, far from vanishing, rose up in a straight line. When the first moments of excitement were over and we had somewhat cooled down, we could see perfectly that the smoke from the firing formed four groups more or less distant from each other, but what group did our fleet form? If the one farthest to the west, then no doubt it was not surrounded and had the open sea before it, and this was a great advantage. If, on the contrary, it formed the second or third, then it was between two fires.

Later on it was noticed that the firing was at a greater distance and decreased in intensity, and that the columns of smoke were moving farther to the west. Had they succeeded in escaping and outwitting the hostile fleet? For the present one thing was certain: Our ships had not gone down in the entrance of the harbor, nor even close to it, and that was of great importance, for the greatest danger was in the channel. Imagine our joy when the Morro advised us by telephone that our fleet was fighting in wing formation and that the enemy did not have the range. Evidently the age of miracles is not over. I will not try to describe what we felt that day—we, at Santiago, who have the honor of belonging to the navy.

I still had the horse at my disposal, and as I remembered the anxiety in which I had left Mr. Bustamente and his delicate state of health, I hastened to bring him the news, which I thought would do him a great deal of good. When I arrived, he knew it already, as every one else did in Santiago. He had been all over the city. I found him radiant with satisfaction.

I may safely say that the 3d of July was a day of true rejoicing, for, as will be seen later when I relate the events of that day, it was believed that our ships had accomplished their object, although at the cost of the destroyers, the loss of which was already known. And although we felt very sad over the victims there must have been, the result, on the whole, was so brilliant that it surpassed all reasonable expectations.

How great were my consternation and sorrow when, at 6 o'clock in the evening, I saw the pilot Miguel López arrive, his appearance changed and his clothing and shoes wet from the drizzling rain, with the news that he had at his house at Cinco Reales five shipwrecked from the Maria Teresa and Oquendo, worn out and weak; that both ships, on fire, had run aground on the coast close to each other west of Punta Cabrera and about 8 miles from the harbor of Santiago, and that a great many more, some wounded and all tired, were on the road.

The Teresa and Oquendo lost, besides the Plutón and Furor! What a horrible contrast and what a sad awakening! In the morning I had believed the ships safe and was already thinking of a telegram from Havana announcing their arrival at that port. At night the news of the catastrophe, the full extent of which I did not know even then!

But as my comments and lamentations do not explain what had happened, I will give the news as it was received in the course of the day at the captaincy of the port. It will explain why, for eight hours, we believed at Santiago de Cuba that the Spanish fleet was in safety.

XXVII.—Naval Battle of Santiago de Cuba.

July 3d.—The hostile fleet in sight, about 5 miles distant.

At 9.45 the Spanish fleet went out. Shortly after, a violent bombardment was heard.

At 10.40 the Morro said: "The Spanish fleet is fighting in wing formation at Punta Cabrera; the enemy does not have the range and it seems as though they would succeed in escaping. The American fleet is composed of the Brooklyn, Indiana, Iowa, Texas, Massachusetts, Oregon, and one yacht. The ships from Aguadores have come to assist in the battle."

At 11.15 no more firing was heard.

At 12.30 the Morro said: "When the fleet went out it did so slowly. After the four large ships had gone out the destroyers went, and all of the American ships fell upon them. Our fleet opposed the attack and the destroyers hurried to join them, but near Punta Cabrera one of them took fire and ran ashore. The other continued to fire and when she saw herself lost she lowered two boats filled with men; one reached the coast, the other was captured. On leaving the destroyer they set it afire and she ran aground burning."

So they are both lost. When our fleet passed Punta Cabrera one of the ships, apparently the Teresa, went close to the shore and a great deal of smoke was seen. The Iowa and New York were pursuing her and the others followed them. By this time the hostile ships from Aguadores were already taking part in the fight.

At 2 an English warship was signaled to the south.

At 3 the Morro said that the ships which pursued our fleet were 24 in all; 15 warships, armored and unarmored; the others merchant vessels equipped for war.

At 6.30 the pilot, Miguel López, said that at his house at Cinco

Reales, he had five shipwrecked from the Teresa and Oquendo, and they said there must be others at Cabañitas.

The tug Esmeralda, with the second commander of Marine and Ensign Nardiz, with the pilot, Lopez, and ten armed sailors, went out to gather them up. Forces of the army also went out in the steamer Colón to protect those who might be returning by roads and paths along the coast.

At nightfall Colonel Escario's column arrived from Manzanillo.

My friend, Mr. Robert Mason, Chinese consul, who is interested in naval matters, and has a good understanding of everything concerning them, witnessed the battle from the Vigia del Medio, which is the highest mountain in the bay and overlooks a great part of it. But we must take into account that, as it is quite distant from the coast, the ships that pass close to it can not be seen. As soon as he arrived he told me what had happened as he had seen it, and I put it down as he dictated it to me. The following is what I heard from his own lips, word for word, without changing anything in this interesting account:

"The Teresa went out first, then the Vizcaya and Colón; after a somewhat longer interval, the Oquendo, then the destroyers. The Admiral passed the Morro at 9.45. A little to windward of the Morro (west) was the Brooklyn. Opposite the Morro another ship, apparently the Massachusetts, and I could distinguish no other warships from the Vigia. When the Admiral passed the Morro the hostile ships and the Morro and Socapa opened a violent fire simultaneously; the hostile ships that could not be seen and that were at Aguadores also opened fire at the same time. After passing the Morro, the Admiral went west and was lost from sight on account of the Socapa. The Vizcaya followed, and then the other two. In the meantime the destroyers remained in the bay. The Spanish ships were now visible again, the Vizcaya in the lead, the Colón, Oquendo, and Maria Teresa in line ahead at a certain distance from the American fleet. The Spanish fleet was firing slowly, the American ships lively, so that I did not lose sight again of the Spanish ships, but often of the American ships on account of the smoke. In the meantime the American warships and two yachts were gathered opposite the Socapa, and when the destroyers came out it seemed impossible that they should be able to escape. The fire was horrible from the large guns, as well as from the rapid-fire guns. Nevertheless, the destroyers were lost from sight, but they appeared again, firing from their stern guns. As long as the ships could be distinguished it could not be estimated whether they had received injuries of any kind. When they disappeared from sight, at 10.30, we could see no injuries in the masts or smokestacks, or anything special. At this time we saw all the American ships firing in a westerly direction, and at that hour the New York, which had not yet entered the fight, passed the bay headed westward. When I left the battle I had not seen any ship run aground nor on fire, either Spanish or American."

Before I continue, in order to give a better understanding, I will recall the fact that the coast between Santiago and Punta Cabrera, a stretch of about 6 miles, forms a kind of bay on which are situated Cabañas and Guaicabón; that Punta Cabrera projects south and is very high land, consequently the ships which are west of it and close to the coast cannot be seen. It is absolutely necessary to remember this in order to understand why it was that the final result of the battle was not seen.

At 9.30 the Spanish fleet started up; first the Maria Teresa, Admiral Cervera's flagship, the Vizcaya, then the Cristóbal Colón, and Oquendo. Behind these the Plutón and Furor. This was the order of sortie as I learned from the pilots, López and Núñez.

The Brooklyn, Iowa, Indiana, Texas, Massachusetts, Oregon, and one yacht were waiting at the mouth of the harbor. The others arrived soon from Aguadores, where they had been, with their engines going and under steam. One of the last ones to arrive was the New York, which, the same as the Brooklyn, has a 20-mile speed.

The Spanish ships, which necessarily had to go out in line-ahead, received, as each went out, the fire of all the American ships, which they could not answer until they had passed the bank of Diamante, because they could not present the broadside, consequently their guns, to the enemy. Therefore, as long as they were inside of the harbor, they all sustained a terrible fire.

Nevertheless they came out without serious injuries and reached the open sea.

The Vizcaya, which was the fastest ship, but had not had her bottom cleaned, was making only 13 miles, and the other ships had to regulate their speed by hers in order to preserve the line.

I suppose from what happened and taking into account the order of the sortie that Admiral Cervera intended to protect the retreat of the Vizcaya, accompanied by the Colón (which did not have her turret guns mounted), with the Oquendo and Maria Teresa, and then have the latter, by putting on forced draft, rejoin the former, but both were set on fire by the stern, which they presented to the hostile fire, and they were soon converted into one immense blaze and went aground on the coast, the Teresa about 7 miles from Santiago harbor, west of Punta Cabrera, then close to her the Oquendo. These events I learned at nightfall from the shipwrecked who had arrived. The fate of the Vizcaya and Cristóbal Colón I will anticipate, in order to complete the account of what happened to the whole fleet as it was told me by an officer of the Austrian cruiser Maria Teresa (same name as ours) the next day.

When the Oquendo and Teresa had been lost, two or three American ships remained there to consummate the surrender and gather up the shipwrecked and wounded and take the others prisoners. The other ships continued to pursue the Vizcaya and the Colón. The first of the two also took fire at the stern and stranded at a distance of about 20 miles (toward Aserradero); the second did not take fire. Probably her engine was damaged and she ran up on the coast about 60 miles distant (off Turquino).

Such was the hecatomb (for there is no other name for it) of our ill-fated fleet, and I do not believe that history records another like it. Not a single ship was saved from the catastrophe. The commanders and officers of all the ships knew well what was going to happen, when, calm and serene in spite of everything and ready to do their duty fully, they took leave of each other and of their comrades who remained on shore, as they did not belong to the fleet.

A person who has witnessed and seen with his own eyes an event like the one which I have in vain tried to describe, must necessarily be of interest, even though of little prominence and education. For that reason I have had the pilots Miguel López and Apolonio Núñez, who took out the Teresa and Oquendo respectively, repeat to me a hundred times what they had seen. I shall not copy everything they said; that would be too much of a task, but only what relates to the battle and which gives an idea of that veritable hell, for that is what the mouth of Santiago harbor was for fifteen minutes.

Miguel López, who is cool-headed and daring on land as well as on the sea, said to me about as follows:

"I was in the forward tower by the side of Admiral Cervera, who was as calm as though he had been at anchor in his own cabin, and was observing the channel and the hostile ships and only said these words:

"'Pilot, when can we shift the helm?' He had reference to turning to starboard, which could only be done after we had passed Diamante Bank. After a few seconds he said:

"'Pilot, advise me when we can shift the helm.'

"'I will advise you, Admiral,' I answered.

"A few moments later I said: 'Admiral, the helm may be shifted now.'

"In a moment the Admiral, without shouting, without becoming excited, as calm as usual, said: 'To starboard,' and the next minute, 'Fire!' At the same moment, simultaneously, the two guns of the turret and those of the port battery fired on a ship which seemed to me to be the Indiana. I thought the ship was sinking. I cannot tell you, Don José, all that passed. By this time there were already many dead and wounded in the battery, because they had been firing on us for some time, and I believe that in spite of the water that was in the ship she was already on fire then. The Admiral said to me:

"'Good-by, pilot; go now; go, and be sure you let them pay you, because you have earned it well.' And he continued to give orders."

These were, more or less, the words that Miguel López spoke to me, and which he repeats to any one who wishes to hear them.

Apolonio Nuñez, who took out the Oquendo, is very different from López, not daring, but rather easily frightened. These were his impressions:

"When we arrived at Santa Catalina battery, they were already firing. There was a hail of bullets on board which cannot be compared to anything. I was in the tower looking after the course of the ship. The commander, who is very kind, and who knew me because I had taken the ship in on the 19th, said to me:

"'You can go, pilot; we can get along now, and later on perhaps you will not be able to go.' I thanked him and should have gone gladly enough, I can tell you, but I was afraid they might shift the helm before they passed Diamante, and you can imagine, Don José, what would have happened. I remained on board, and when we had passed the bank I said to him: 'Commander, you can shift the helm.'

"'Go, pilot, go,' he said, and then he commanded to put to starboard and shouted, 'Fire!' The noise caused by the big forward gun and the shaking of the ship made more impression on me than the fire of the Yankees. I thought the Oquendo had been cut in two. I do not even want to remember it. I was lowered in a boat and then I thought I was a dead man. The bullets were falling all around me. Finally I reached Estrella Cove, where Miguel López had already arrived. I did not even dare look at the battle, which was now outside of the harbor."

These two accounts, which perhaps, do not inspire the interest which no doubt they possess, because I have not been able to remember the exact words of the men, although in substance they are the same, may give an idea of that never-to-be-forgotten sortie which had such fatal consequences.

I supposed that the American fleet would await the Spanish fleet at the mouth of the harbor and absolutely prevent it from going out, under penalty of having the ships attacked. But that requires a great deal of courage and presence of mind. Nevertheless, it would have been the safest means for accomplishing it. By not doing so they exposed themselves to being outwitted and this is proved by the fact that our ships succeeded in getting out of the harbor and as far as Punta Cabrera (about 6 miles), so that they really accomplished the most difficult part, and there is no doubt that if they had not been set on fire and if they had had a speed of even 18 miles they would have run the blockade.

It will also have been noticed that the three ships built in Spain all had the same fate; they were burned. The one built in Italy, although not having the turret guns, and which had suffered from the hostile fire much longer, because she "died" later than the others, was not burned; she had a different fate, but not that. I believe I am not bold in affirming that if the four ships had been protected like the Colón, they would have outwitted the enemy's pursuit. In that event they might have reached Havana, for as the whole, or nearly the whole, American fleet was in front of Santiago, they would have met no one to prevent them and the situation would have been very different.

A few of the shipwrecked arrived in the tug Colón and were embarked by our commander of marine in the cruiser Reina Mercedes.

The tug Esmeralda, with Ensign Nardiz, ten armed sailors, and the pilot López, went to Cabañitas Cove to gather up shipwrecked; but, although they made a careful search, they found none.

At night Colonel Escario's column, whose forces have already been mentioned, arrived from Manzanillo. The next day General Escario told me that when he heard the fire of the battle in the morning, he proceeded with a small vanguard to the heights of the harbor of Bayamo, and that the detachment there told him the same thing, viz. that they saw our ships run the blockade and disappear past Punta Cabrera.

To my mind there is nothing so interesting and eloquent as the account of a naval battle by persons who have taken part in it. Lieutenants Bustamente and Caballero, second in command of the destroyers Furor and Plutón, respectively, who escaped by a miracle from the horrible hecatomb, in which the greater part of their crews perished, told me two days after the catastrophe, still sick and tired, of the battle which their ships sustained. Their accounts follow:

Mr. Caballero: "The last ships were already outside of the harbor when the destroyers, which had stopped between the Socapa and Cay Smith for the purpose of getting up steam, proceeded and passed through the channel as far as Punta Morrillo, where the Furor, which was in the lead, put to port as though trying to go east, but when she discovered the Gloucester and other ships which were near Aguadores, she put to starboard, following the lead of our fleet, which was already at some distance, opening fire on the Gloucester which we (the two destroyers) had left astern. And the Indiana, Oregon, Iowa, and Texas, which we had passed in the order named on the port hand, continued to fire very rapidly, which made it extremely difficult for us to serve the guns. After we had passed Cabañas we commenced to gain on the Furor, and when we came up with her and were about 50 meters to starboard, she listed rapidly on that side, her rudded having been disabled, and passed astern of us at a distance of 1 meter, and sank by the stern, standing up almost vertically, and was buried in the sea a moment later, before reaching Punta Cabrera.

"As we (the Plutón) were making a great deal of water we continued close to the shore to reach Punta Cabrera, and when we were close to the headland which it forms, we received a 32-centimeter projectile which exploded the forward group of boilers, blowing up the whole deck and cutting off communication between the two ends. She then veered to starboard and struck on the headland, tearing off a great part of the bow. The shock threw her back some distance, then she struck again. I jumped into the water and reached the shore.

"I climbed up on the headland of Punta Cabrera and lay there for about fifteen minutes, during which the fire continued. When it was at an end I went into the mountains and gathered up such personnel of the ship as I met—about 20 or 25—and with them I went around a small hill for the purpose of hiding from the coast and took the road to Santiago de Cuba, avoiding the roads and seeking the densest thickets and woods. The pilot, on pretext that the road which I was following was not a good one, left us and did not again put in an appearance. We continued walking in an easterly direction—some clothed, others naked, and the rest half clothed—for two hours, resting now and then, and trying to keep close to the coast. When we reached the beach we met Lieutenant Bustamente with a group of shipwrecked from the Furor (his ship) and some from the Maria Teresa. We saw a yacht with the English flag close to the coast maneuvering back of Punta Cabrera, as though trying to gather up the shipwrecked there. We made signals to her with a shirt, and seeing that she paid no attention to us we walked on, avoiding the formation of large groups and hiding ourselves as much as possible.

"About 3.30 we reached the harbor of Cabañas, which we had to cross swimming, and on the opposite shore, about 9 o'clock at night, we reached the trenches of the Socapa, where at last we could rest for the night, with the assistance of some guerrillas, who supplied us with what they could."

Mr. Bustamente: "When we (the Furor) reached the mouth of the harbor and saw the Spanish fleet, we thought that by shaping our course westward we could seek the protection of the Spanish fleet, which was already at some distance, and we maneuvered accordingly. One of the projectiles struck one of the hatches of the boiler ventilators, thereby reducing the pressure and consequently the speed of the ship. By this time the projectiles were falling on board in large numbers. One of the shells struck Boatswain Dueñas, cutting him in two; one part fell between the tiller-ropes, interrupting them momentarily, and it was necessary to take it out in pieces. Another projectile destroyed the engine and the servo-motor, so that the ship could neither proceed nor maneuver. Another had struck the after shell room, exploding and destroying it.

Our torpedoes had their war-heads on and were ready to be used, but we did not launch them because we were never at a convenient distance from the enemy. Under these circumstances the commander of the destroyers, Captain Fernando Villamil, gave orders to abandon the ship, and I with part of the crew jumped into the water, about 3 miles from the coast. In the water, one of the men near me, I believe the first boatswain, was struck by a bullet in the head and was buried in the water forever. The ship in the meantime, after a horrible series of explosions, went down. When we reached the land we went in an easterly direction towards Santiago. Shortly after we met Lieutenant Caballero and with him and his men we reached Santiago, and following the same road and the same fortunes; as they are identical, I will not here relate them."

To what has been said it is useless to add another word.

XXVIII.—Causes of the Loss of the Naval Battle of Santiago de Cuba.

Words fail me to describe the painful impression produced upon me by the disaster of the four cruisers and two destroyers under Admiral Cervera's command, and by what I may call the hecatomb of their crews, which was not complete for the only reason that the battle had taken place so near the shore, where the ships, all on fire, could run aground, rather than surrender to the enemy. In less than two hours the ships were destroyed, and yet, this is not strange. I am surprised, on the contrary, that they were not sunk in the channel.

The loss of the fleet had been foretold by all its commanders, with whom I have talked more than once, and was prophesied, so to speak, as soon as the order was received at the Cape Verde Islands to start for Cuba, and the admiral who was in command advised the Government to that effect several times; these official communications are still in existence. But it seems that public opinion in the island of Cuba, especially at Havana, required the presence of the fleet in those waters, and between that and the very sensible and logical reasons advanced by the admiral, the Government decided in favor of the former, and the fleet departed, shaping its course to the west. From that moment the loss of the fleet became inevitable, and it was only a question of time, as will be easily understood from what follows.

The fleet left the Cape Verde Islands with no more coal than was in the bunkers, the greater part of which must necessarily be used up during the voyage across the Atlantic Ocean. The three destroyers, Plutón, Furor, and Terror accompanied it and had to be convoyed and supplied with coal, which involved difficulties and delays.

At Martinique (where the Terror was left, being no longer able to follow the fleet) the ships could not coal; and at Curaçao, in spite of the government's promise that they were to find a ship there with fuel, which did not put in an appearance, only two of the ships could get a small number of tons.

The order to proceed to the island of Cuba was there; what could they do under such circumstances? The only natural and logical thing: go to the harbor that was nearest and for that reason offered the least dangers, go to Santiago de Cuba, which Admiral Cervera believed well defended, as the harbor is suited for that purpose, and supplied with provisions. How great was his surprise when he found that only two guns worthy of the name defended its entrance, and that provisions were lacking in the city, as well as ammunition and everything else.

I have already stated, and will here repeat it, that during those days of May, before the hostile fleet appeared with forces superior to ours (that is, from the 20th to the 27th) the ships could not go out, not only because they did not have coal enough, but also because there was considerable swell in the sea, which prevented them from going out, as was stated by all the pilots of the locality, who said that the ships were almost sure to touch bottom, especially the Colón, which drew more water than the others.

We must take into account, for it means everything for a fleet, that they had not cleaned their bottoms for a long time and their speed was therefore far from what it should have been; the Vizcaya, above all, was not able to make 13 miles, and later, after being in Santiago harbor for 46 days, her speed was reduced to even less.

But even if there had been no swell in the sea to the south and the ships could have gone out, where would they have gone? To Havana by the shortest route? They would have met Sampson's fleet, as Admiral Cervera knew only too well, and that was just what he wished to avoid. Perhaps he might have succeeded by taking a course which he would have been least expected to take, through Providence Channel, for instance; and this did occur to Admiral Cervera, but it was impossible, for the simple reason that he did not have fuel enough for so many days of navigation.

Moreover, when the fleet reached Santiago harbor, everybody there, as well as in the Peninsula, believed it safe and congratulated its commander on his success and his clever maneuver; and when I say "everybody" I do not mean the common people only, but the official element. Could there be a better proof that Admiral Cervera complied with the wishes of the Government?

The fleet received definite order from the Captain General of the Island of Cuba to leave the harbor of Santiago, which he reiterated, in spite of Admiral Cervera's remonstrances. After that, what was to be done? Only one thing: go out, as indeed they did, resigned, but calm and serene, those heroes; for all those who went out with the fleet to certain death, as every one knew, deserve that name. And I say that they went out calm and serene, and shall say it a thousand times, for only thus can ships be maneuvered in so narrow and dangerous a channel, without any of them running aground, which can happen so easily even under ordinary circumstances, when it is not necessary to oppose the fire of a hostile fleet, and with ships of less draught and length. The sortie from that harbor, under the circumstances under which those ships effected it, I do not hesitate in calling the greatest act of valor, fearlessness, skill, intelligence and practical experience in seamanship that can be conceived. This was stated repeatedly and with great admiration by the commanders and officers of the English corvette Alert and the Austrian cruiser Maria Teresa, who, it may be said, witnessed the battle.

The number of ships that were awaiting ours at the mouth of the harbor, and with which the latter had to fight, as well as their nature and the kind of armament they mounted, was given in one of the first chapters, from statistics of the American Navy. This alone is more than sufficient to demonstrate that, in view of the inferiority of ours in quantity and quality, it was impossible to sustain the battle.

But there is more, much more, to be added in order to explain what happened in the naval battle of Santiago de Cuba, the greater part of which is not known by the people in Spain.

I have already stated that the Colón, the only really protected ship of the four that composed the fleet, did not have her turret guns. Of the 14-cm. guns of the Teresa, Oquendo, and Vizcaya, which are the ones that do most of the firing in a battle, six had been declared useless; and while the Teresa could change hers, the Oquendo and Vizcaya could not do so, and had to fight, the former with one, the latter with two useless guns, as I have stated.

Moreover, the supply of ammunition for all of the ships was inadequate, and the Teresa had 70 useless charges. The greater part of the primers were no good, and consequently the guns did not go off. The breech-plugs were imperfect, so that after the second or third shot they no longer closed. The firing-pins blew out, and from many of the survivors of the Oquendo and Teresa I have learned that a number of the men serving the guns were wounded by their own pieces. Therefore, if the whole thing were not so sad and serious, it might be said that the guns of our ships were like the "carbine of Ambrosius," which went off at the breech; that is, that far from injuring the enemy, they were a danger to those who had charge of firing them.

The majority of the cartridge cases did not have the required diameter, and on the Maria Teresa it happened that seven had to be discarded before one good one could be found. Under these conditions, it will be readily understood that the armament, which was intended to be converted into rapid-fire artillery, was instead converted into artillery—I do not know what to call it, but it was certainly entirely useless.

After what has been stated, can the result of the battle of Santiago be wondered at? Certainly not. The only thing that may appear strange is that, under such conditions, a fleet should have been sent to the scene of war.

It was under these circumstances that the sortie was made from the difficult harbor of Santiago by those commanders and officers who, convinced that they would all perish, contented themselves with saying farewell to the comrades who remained on shore and whom they never expected to see again.

We Spanish are very proud of the disaster of Trafalgar on account of the heroism which our navy showed on that occasion, when they placed honor above everything else, though our ships were buried in the sea. The battle of Santiago de Cuba is much more glorious even than that of 1805. In this latter battle, thirty-two allied ships of 64, 80, and 120 guns fought with twenty-eight English ships, also of 120, 80, and 64 guns; the forces, therefore, were almost equal; and if the battle was lost, while it might very well have been won, it was because our fleet was commanded by Villeneuve, and the hostile fleet by Nelson. In the battle of Santiago, six ships (if the Plutón and Furor may be called such) had to fight against twenty-four * that were better protected and armed. After these figures, anything else that might be added would appear to be useless.

I have never been able to understand the reason why there was sent to the Island of Cuba a fleet that was in no manner able to cope with that of the United States and which therefore could in no wise prevent the ships of the latter from blockading our ports and controlling the sea; but since it was sent, without its arrival being able to prevent the loss of the island, which was lost, as experience has shown, from the very moment when war was accepted, owing to the conditions prevailing there, then it should have been prevented from being destroyed, as it was, without resulting in any advantage whatever.

The only way of gaining any advantage would have been, in my opinion, taking advantage of the fact that all the hostile ships were in Cuba, to send a few ships of great speed, more or less well armed, to the commercial ports of the United States and bombard them, even though not very effectively. It is probable that public opinion, especially of those who did not participate in the

* The writer makes a strange error in the number of the American ships engaged in this fight. He has evidently counted all those enumerated in Chapter XI. Those ships, however, were scattered among the fleets at Manila, Havana, Key West and Santiago. Those actually engaged were as follows: Brooklyn (flag), Oregon, Indiana, Iowa, Texas, and yachts Gloucester and Vixen. The flagship New York, with the torpedo-boat Ericsson, took part toward the latter end of the engagement, the battle being practically fought by the six ships first named. Counting only numbers of ships, therefore, the Americans had five fighting ships against the Spanish four, with two armed yachts against the two Spanish torpedo-boat destroyers.—O. N. I.

war, would have exacted the return of the ships, and then the Spanish fleet could have left Santiago in perfect safety, and a catastrophe would have been avoided which has brought us no advantage. At the same time, the ports of the island, freed from the blockade, could have supplied themselves with provisions; and although the final result would probably have been the same, it would not have been so immediate.

But all this is nothing more than hypothesis and supposition, and not timely; besides, it was not my object in writing this book. I have told how Admiral Cervera's fleet started from the Cape Verde Islands, how it arrived at Santiago, and how it went out to fight with Admiral Sampson's fleet, convinced that the greater part of the people living in Spain are ignorant of what I have set forth, and also convinced that, when the facts are known, the results will be judged differently.

XXIX.—Sinking of the Mercedes.

July 4th.—Opposite the mouth of the harbor, the New York, Brooklyn, Indiana, Massachusetts, Minneapolis, Vesuvius, one yacht, and seventeen merchant vessels.

At 7 an English corvette arrived and asked for a pilot.

At 9 the Austrian cruiser Maria Teresa arrived.

The boats of both ships entered the harbor.

At 4 they departed with subjects of their respective nations.

At 8 p. m. the cruiser Reina Mercedes started up.

At 11.30 two gunshots were heard in the entrance at the foot of the Morro; afterwards many more.

At 12.45 the fire ceased. It was answered by the Socapa.

There was hardly a day when the hostile fleet and the Morro and Socapa did not exchange shots, or when some information was not received of injuries to one or more of the hostile ships, even of their having been burned and sunk, but as this has never been proved I have said nothing on the subject, being resolved to say nothing except what has been positively proved and what everybody knew who remained at Santiago during the time when the events that are the object of these notes occurred. It is natural that the ships which sustained the fire so many times (the opposite would be improbable) should have suffered some damages and casualties, although they were stationed at a considerable distance, but there is no doubt that they were not serious; if so, they would have been clearly seen.

On the day of the battle of the two fleets I was assured by sailors from the Socapa and by those shipwrecked that they had seen such and such a ship sunk, or such other one on fire, and such and such a tug had taken off some other ship. It seemed probable, but nothing of the kind happened. The next day the ships that had fought with ours were all at Daiquiri, at Aguadores, or opposite the mouth of the harbor; that is the reason why I have never spoken of the damages done to the blockading ships.

The English corvette Alert and the Austrian cruiser Maria Teresa could, of course, not enter the harbor, because we had planted Bustamente torpedoes (although only a part of them) and stretched wires across. The tug Colón went out with a flag of truce to notify them to that effect, and they sent in their boats, towed by steam launches.

From the Austrian officers it was learned at the comandancia de marina what had happened to the Vizcaya and Oquendo in the battle of the preceding day, for they had arrived just in time to hear the gunshots and to see the ships stranded and lost on the coast. All agreed, of course, that our fleet had fought admirably, and, above all, that the sortie of the ships from the harbor under the circumstances under which they executed it, showed a courage, skill, and practical seamanship truly admirable. It is always a comfort to see that justice is being done, and that comfort I had at that time.

As the interior of the harbor did no longer have the safeguard of the fleet, as the Bustamente torpedoes (six of them) had been taken up so that the fleet could go out and had not yet been replaced, and as, finally, the first line of mines no longer existed, the commander of marine decided—General Toral also being of his opinion—to sink the Mercedes (the only ship that was suitable for that purpose) in the narrow part of the channel; consequently, the commander of the cruiser received orders to do so. Hurriedly, for time was pressing, the wounded and sick from the lost fleet were transferred to the steamer Méjico, which had been converted into a hospital and hoisted the flag of the Red Cross. Important papers that had been saved, memoranda, portable arms, beds, and the most necessary things, were taken off the Mercedes, and at 8 p. m., with her commander, Ensign Nardiz, a few engineers, the necessary sailors, and Pilots Apolonio

Nuñez and Miguel López, started toward the entrance, with her bow anchor and stern spring on the cable ready.

At 11.30, as soon as the enemy, who was watching with searchlights, sighted her, he opened a continuous fire on the ship. In spite of this the ship was sunk at the intended place, a very difficult operation under any circumstances and especially under fire, as will be readily understood. Unfortunately the ship did not come to lie across the channel, because it seems a projectile cut the spring on the cable; the sacrifice was useless and the harbor was not obstructed. Yet it was not entirely useless, since the enemy could not take possession of her, as she is all riddled by bullets which she received that night, and I do not believe she can ever again be used.

And since so much has been said of this ship, I will give an account of all the victims of her crew, some on board, some at the Socapa, Punta Gorda, and the Morro, from the beginning to the end of the war.

Commander Emilio Acosta, second in command, was killed. (Here follow the names of the killed and wounded. The list includes 5 dead, 11 seriously wounded—two of them fatally—16 slightly wounded.)

The enemy cut off the aqueduct so that there was no water left in the city, except in the wells and cisterns.

The shipwrecked, who have arrived from the fleet, are Lieutenants Bustamente and Caballero, second in command of the destroyers, respectively; Midshipman Navia; several engineers and about 150 sailors.

Many were murdered by the insurgents with guns and machetes. I say murdered, because I believe there is no other name for killing with guns and machetes men who were not only disarmed, but almost naked, sick, and many of them wounded. I realize the seriousness of such an accusation, but it is the statement of all who have succeeded in escaping.

XXX.—Escario's Column.

As the column which the commander-in-chief had ordered by telegraph from Manzanillo took such an active part in the military events from the time of its arrival at Santiago on July 3, it seems proper that I should give an account of its difficult and laborious march, covering a distance of 52 leagues over territory which had been abandoned two months ago and was in the hands of the enemy and where no help or support could be looked for anywhere.

In order to give an idea of this march, which reflects great honor on the general at the head of the column, the chiefs and officers accompanying it, and the patient soldiers, I will state that of the 52 leagues the only distance where the column could march two abreast was from Almirante to Santa Rita; all the rest of the distance they had to march single file, opening the road with machetes as they went along, as everything was overgrown with manigua. In order that the reader may better understand this march, I will copy the diary of operations of the column.

This diary is as follows:

FROM MANZANILLO TO SANTIAGO DE CUBA BY LAND.

[Diary of the operations of campaign of the forces of the Manzanillo division from June 22 to July 3, 1898.]

"FROM MANZANILLO TO BAYAMO.

"In compliance with orders from the lieutenant general, commander-in-chief of the fourth army corps, in his cablegram of the 20th instant, ordering that the forces of the Manzanillo division should proceed to Santiago de Cuba, Colonel Federico Escario, for the time being commanding general of said division, having made the necessary preparations for such a long journey, properly equipped the troops and rationed them for six days, commenced the march on the 22d at the head of a column composed of the first and second battalions of the Isabel la Católica regiment of infantry, No. 75; the first battalion of the Andalusia regiment, No. 52; the Alcántara Peninsular battalion, No. 3; the battalion of Puerto Rico chasseurs, No. 19; the second section of the first battery of the fifth mountain regiment; part of the eighth company of the first regiment of sappers; mounted guerrillas from Calicito, Bayamo, and Manzanillo; five medical officers and thirty men of the medical department destined for the Santiago hospitals, and the tenth company of the transportation column in charge of 13,000 rations of hardtack (*galleta*), and 15,000 extra rations loaded on 148 mules, and 50 private beasts of burden properly loaded.

"This column, comprising a total of 3,752 men, left Manzanillo at 5 o'clock p. m., and at nightfall reached Palmas Altas, where its commander gave orders to encamp for the night, which, however, did not afford the soldiers the rest that it was intended it should, owing to a steady downpour, so that only a few could lie down.

"The 23d dawned more brightly than the preceding day; the camp was struck, the column reorganized, and the difficult march continued at 5.30; high weeds had to be cut down to open a road on the left bank of the Yara River, which route the commander chose in order to obviate passing through towns which might be occupied by the enemy, thereby complying with the order to avoid encounters, contained in the cablegram of the 20th, above referred to.

"The column passed through the Don Pedro plain and arrived at dark at the ford of the Yara River, near the town of the same name. Orders were given to encamp here. The column had been harassed all day, especially while preparing to occupy the camp, when the enemy opened a steady, lively fire, which lasted ten minutes, killing one of our men and wounding three. The fire was answered by the vanguard of the column. The usual reconnoissance having been made by the mounted force, which reported that the enemy had withdrawn, the column encamped and the night was spent without further events and under more favorable conditions than the previous night, for a clear sky and a dense grove allowed our soldiers comparative rest until daybreak of the 24th, when the column, rising at the sound of the reveille, and after drinking coffee, was again formed and organized by 6 o'clock, when it continued its march through Arroyo Pavon, Ana López, and Sabana la Loma, sustaining slight skirmishes, in which the column had one man killed and one wounded. The column encamped on the banks of the Canabacoa River.

"On the 25th, at the usual hour, the camp of the preceding day was struck and the column reorganized while heavy showers were falling; the march was continued through Las Peladas, Palmarito, and across the Buey and Yao rivers. The camp was pitched at Babatuaba. The same as yesterday, the column was harassed all day, always repulsing and dispersing the enemy. One man was killed during the skirmishes.

"The night passed quietly, and at 6.30 a. m. of the 26th the march was recommenced. The day was eventful and of excellent moral and material results for the Spanish cause, as will be seen from the fact that our forces entered the city of Bayamo after a long march and pursued and scattered hostile detachments through the heights of San Francisco, Peralejo, across the Mabay River, and at Almirante, where the camp was pitched, not without some resistance from the enemy, who was severely punished by the accurate fire of the column, without causing us the least damage.

"The diary of those days would not be complete without an account of the entrance into Bayamo above referred to. This maneuver was undertaken, contrary to the orders to avoid encounters contained in said cablegram of the 20th from the commander-in-chief of the fourth army corps, for the reason that the commander of the column thought it would be discouraging to the soldiers to be so near said city without entering it, and that their spirits would rise, on the other hand, if they were allowed to do so and show the enemy and the ungrateful people of Bayamo that there were still Spaniards left in Cuba, and to disperse the enemy, for which purposes there was strength and time enough left that day. The commander therefore decided to explain these reasons to the commander-in-chief and ordered that Colonel Manual Ruiz, second commander of the column, should occupy the city with the cavalry and 600 infantry, the latter to be divided into two columns and the cavalry to form the third. Interpreting faithfully the wishes and orders of Colonel Escario, Colonel Ruiz left the camp at Almirante at 3 o'clock p. m., after the troops had taken their first mess, and divided his forces into the three groups mentioned, himself taking command of one of the groups of infantry, placing the other in charge of Lieutenant Colonel Baldomero Barbón, first commander of the Alcántara battalion, and the mounted force in charge of Luis Torrecilla, commander of the first battalion of the Isabel la Católica regiment. These three columns of attack, advancing steadily on three different points, succeeded in approaching the city without disturbance or interruption. Evidently the enemy was desirous of saving his fire, for alarm signals were heard and groups were seen running from one place to another of the precinct, leaving no doubt that the enemy was near.

"The columns in the meantime continued to advance rapidly and in silence, deployed in perfect order of battle, and thus they arrived at the banks of the Bayamo River, where hostile forces tried to check them by a steady musket fire from the city. But this attempt became futile when the signal of attack was given, at the sound of which our soldiers, arms in hand and without firing a single shot, crossed the river at a run; with only one casualty and without further resistance, they triumphantly entered the stronghold of the enemies of Spain. In disorderly and precipitate flight that savage tribe retreated. Our forces went to occupy the forts and principal avenues, and in separate groups they reconnoitered the whole city, gathering up at the military comandancia of the insurgents several packages of their records and correspondence, and the station and part of the telegraph line which the rebels had established with Jiguaní and Santa Rita were wrecked.

"No information concerning the enemy could be obtained from the people of Bayamo, who, as usual, kept silent; a few only opened their doors from sheer curiosity, plainly showing in their faces the disgust they felt at the presence of Spanish soldiers on that soil where it had been believed that they would never again set foot.

"Our forces then returned to the camp at Almirante. The result of that day's work was not known at first, but it was afterwards learned that the enemy had 19 casualties, 10 killed and 9 wounded. The night at Almirante passed without further incidents, and thus ended the first part of what may well be called the glorious march from Manzanillo to Santiago.

"FROM BAYAMO TO BAIRE.

"At daybreak of the 27th the camp at Almirante was struck and the column continued its march across the plain of Guanábano, through Chapala and across the Cautillo River, destroying on their way the enemy's telegraph line from Bayamo to Santa Rita, where the camp was pitched for the night, which was spent without any further incidents.

"At 6 a. m. of the 28th the march was resumed, the column proceeding to Baire via Cruz Alta, Jiguaní River, Upper Jiguaní, Piedro de Oro, Granizo, Cruz del Yarey, and Salada. The enemy, in greater number than on preceding days and in control of the heights which overlook the ford of the Jiguaní River, tried to prevent our forces from crossing; but their intention was foiled by timely flank attacks ordered by the commander of the column, protected by accurate artillery fire. After the river had been forded, the march was continued without interruption to Cruz del Yarey, where the rebels appeared again, offering less resistance, and we defeated them once more. They seemed inclined, however, to continue to impede the march, which was apparent upon the arrival of our column at the ruins of what was formerly the town of Baire; they were waiting there, and as soon as they espied the column they opened a galling musket fire, which was silenced by the rapid advance of our vanguard, who compelled them to retreat in shameful and precipitate flight. In this encounter Colonel Manual Ruiz, second commander of the column, was wounded and his horse killed under him; four soldiers were killed and five wounded. The column encamped and spent the night at Baire.

"The high weeds which during almost all those days completely covered the soldiers and hampered their progress, causing at the same time a suffocating heat, which made it almost impossible to breathe, and cutting off the road, which had to be opened by dint of hard work, rendering the march extremely laborious and often making it necessary to proceed in single file; the frequent rains, which not only soaked the clothing, but also the ground, making it slippery and difficult to walk on for such large numbers; the sickness caused by the inclement weather and the hard work of these operations; the ever-increasing convoy of stretchers; the consideration that one-half of the journey had been accomplished, and the further very important consideration that the column had arrived at a place where it would be easy to throw the enemy off the track, as they would not know what direction our forces might take, there being three roads leading from here to Santiago; all these were reasons which the commander of the column took into consideration when he decided to suspend the march and rest during the day of the 29th. It was so ordered owing to fatigue; but the enemy kept harassing us and we had three more wounded.

"LA MANTONIA.

"At daybreak of the 30th the camp at Baire was struck and the column proceeded to Palma Soriano, where the wounded and dead were left, and continued its march via Ratonera, Doncella

Creek, and the Contramaestre River to La Mantonia, where the camp was pitched and the night spent.

"Before the column was deployed on the road to Ratonera, the enemy from intrenched positions opened fire, which was answered and silenced by the first forces leaving the camp. The commander of the column foresaw that such attack would be repeated, and in order to obviate casualties, thus further complying with the order of the aforesaid cablegram from the commander-in-chief of the fourth army corps, he changed the route, and our forces, thus eluding the ambuscades, arrived at the slopes of Doncella Creek, the ford of which was reached by a narrow pass and difficult ravine. The rebels occupied positions here; our vanguard brought them out without answering their fire. When the column had been reconcentrated after fording the Doncella, they prepared to ford the Contramaestre River, where the enemy was awaiting us, which fact they had announced themselves by written challenges and threats which they had left along the road. Lieutenant Colonel Baldomero Barbón, of the Alcántara battalion, who since Colonel Ruiz was wounded had been in command of one-half of the vanguard brigade, deployed his forces in perfect order of battle and advanced resolutely. Commanding positions overlooked the clear and unobstructed road which the column had to follow after coming out of the mountains through the narrow valley of the Contramaestre, and moreover they had to scale the steep and tortuous ascent of the opposite bank. Without other shelter than the high weeds which, as usual, impeded the march, without other trenches than their own hearts, these brave soldiers, with their commander at their head, advanced calmly and in perfect order, accepting the challenge which had been addressed to them. The enemy had told the truth; there they were in large numbers occupying those favorable positions which would have been impregnable if they had been held by any one who knew how to defend them; but not expecting that we would accept the challenge, they allowed themselves to be surprised by a lively musket fire and effective artillery discharges, which demoralized and dispersed them, and the rapid advance of our forces rushing upon them arms in hand did not give them a chance to rally. The enemy, being unable to do much firing, retreated with little resistance and having suffered a number of casualties, leaving the field and their positions to those who, understanding the sacred duty imposed by honor, had known how to pick up the glove that had been thrown to them, and regardless of danger and without measuring their strength had marched on unflinchingly in search of the death with which they had been threatened. Having crossed the Contramaestre and passed through extensive pastures, the column arrived at a farm (*finca*) known as La Mantonia, where a number of huts of all sizes and many recent tracks indicated the proximity of a large hostile force. And indeed, soon after the first forces of the vanguard had entered that large encampment, the enemy tried to check our advance by a galling fire from the slope of a mountain where they were intrenched, controlling a line of 1,200 meters, through which it was necessary for us to pass unprotected, as the high weeds made any deployment of the column and advance of cavalry impossible. By order of Lieutenant Colonel Barbón, the two companies of the vanguard of the Alcántara battalion, in command of Francisco Gonzáles, who rendered himself an exact account of the hostile position, advanced steadily and without answering the fire, following the only passable trail, and engaged the hostile position on the left flank, compelling the enemy by repeated discharges crossed with the few that the column was able to fire, to abandon the trenches, leaving us a great deal of ammunition, mostly of the Remington type.

"In the fierce battles of that day Captain Jenaro Ramiro, of the Alcántara battalion, and 9 privates were wounded and 5 killed.

"AGUACATE.

"At daybreak of July 1 the column resumed the march and reached the ford of the Guarinao River, after passing through Las Lajas, where the enemy held advantageous positions from which our vanguard routed them without much resistance. After crossing the Guarinao, small detachments sent out surprised two ambuscades; the column sustained insignificant skirmishes with outposts and small reconnoitering parties, which indicated that large hostile forces were not far off. Subsequent events showed that this theory was correct. When the column arrived at a rugged place dominated by steep heights forming an amphitheatre, they discovered in its center a camp of recent construction, sufficiently large to accommodate 2,000 men. A rapid glance convinced us that the site was specially adapted for an ambuscade. Colonel Escario, realizing this and taking precautions accordingly, gave orders for the column to proceed in its advance and for the artillery to take positions. The enemy did not wait to be surprised, but opened fire at once from Aguacate hill, the station of our heliograph, and adjoining hills to the right and left in an extensive intrenched line. Our soldiers maneuvered as though on drill, and advancing steadily, two-thirds of the column entered the battle, and that hail of lead which strewed death in its path was not sufficient to make them retreat or even check them. Calmly, with fearless heroism, they advanced, protected by the frequent and sure fire of the artillery and skillfully guided by their chiefs, and with the cry "Long live Spain!" and charging with bayonets, they simultaneously took those heights which were so difficult and dangerous to scale, beating the enemy into precipitate retreat, so that they could not gather up their dead and wounded. Seventeen dead were left on the field, also ammunition of various modern types. There were moments during that battle when the tenacity of the enemy and the order with which they fought gave the impression that they might belong to our own column. This report spread rapidly and reached Colonel Escario's ears, who, fearing that this might really be the case, gave orders to suspend the fire, and tried to make himself known by bugte signals. But this precaution was useless, and the commander becoming convinced that he was fighting rebel forces, ordered the attack to be renewed and the hostile positions to be taken. To do the enemy justice it must be stated that they defended these well-chosen positions with persistency and in good order, and that they rose to unusual heights that day, making this the fiercest battle which we sustained on the march from Manzanillo to Santiago and one of the most remarkable ones of the present campaign. Our casualties consisted of 7 dead and 1 lieutenant and 42 privates wounded. Large pools of blood on the battlefield showed the severe chastisement which the enemy had suffered at onr hands. When the column had been reorganized, the march was continued to Arroyo Blanco, where the night was spent.

"FROM ARROYO BLANCO TO SANTIAGO.

"From Arroyo Blanco, where the column had camped during the night, it proceeded to Palma Soriano, fighting the enemy all along the road, on both sides of which the latter occupied good positions and endeavored to detain the column at any price. Engaging the enemy in front and on the flank, a passage was forced and the column reached Palma Soriano at 3 o'clock p. m. The battle of that day caused us 4 dead and 6 wounded.

"From Palma Soriano the commander of the column, by heliogram sent to San Luis, announced his arrival to the commander-in-chief of the fourth army corps at Santiago, and in reply he was notified that large United States forces had landed and were surrounding a part of the city, and that it was, therefore, of urgent necessity to reënforce the place, the defenders of which were few, and to force the march as much as possible. Desirous of complying with this order, Colonel Escario, who realized that the soldiers must be prepared to accomplish the rest of the journey with the greatest possible speed, had the following order of the column, dated at Palma Soriano, July 2, 1898, read to the companies:

"'Soldiers: We left Manzanillo because the enemy was threatening Santiago de Cuba. We must hasten to the assistance of our comrades; our honor, which is the honor of our fathers, calls us there.

"'I, who am proud of having been able to be with you in these days when our country requires of us twofold energy and courage, address these few words to you in order to tell you that I am highly pleased with your behavior and to point out to you the necessity of making a supreme effort to save the honor of our beloved country, as we have done so far.

"'Then say with me, 'Long live Spain!' and let us go in search of those who are desirous of finding out what each one of you is worth. The victory is ours.

"'Your Colonel, ESCARIO.'

"After a plentiful and nourishing meal the troops were ordered to rest. At 2 o'clock in the night the reveille was sounded, and the column, organizing immediately, resumed its march, which the soldiers tried to hasten as much as possible, with no other stimulus than that imposed by duty, of which they were constantly reminded by the cannonades that could be heard in the distance in the direction of Santiago. With slight skirmishes, and without eating nor resting, these brave soldiers reached the pass of Bayamo, where they had the first view of the city of Santiago. Here it was learned that on the same day our fleet, forcing the entrance of the channel, which was blockaded by the American ships, had gone out in search of death, which is the fate reserved for heroes.

"It was now between 10 and 11 o'clock in the morning of the 3d, and when Colonel Escario noted the intense cannonade in the direction of the city, he organized a flying column which was to march as fast as possible, leaving the rest of the column with the train, in command of Colonel Ruiz Rañoy, to follow at once.

"The flying column was formed of the first battalion of the Isabel la Católica regiment, in command of Commander Torrecilla, with 30 of the strongest men of each company, the whole cavalry, and the two artillery pieces. The command of this column was placed in charge of Lieutenant Colonel Baldomero Barbón of the Alcántara battalion.

"This column advanced toward Puerto Bayamo, from which point Colonel Escario proceeded to the city with a section of cavalry, arriving there at 3 o'clock p. m. The rest of the flying column reached Santiago between 4 and 4.30, and the nucleus of the column with the train between 9 and 10 o'clock p. m.

"Those worthy chiefs, officers, and long-suffering soldiers, that handful of brave men, constantly defeating the enemy who persistently tried to check them, rising superior to the inclement weather, to sickness and fatigue, had arrived at the post of honor after a supreme effort and after victoriously crossing the Alps of Cuba. It is not to be wondered at that, when they came in sight of the city, they took off their hats, and with tears in their eyes opened their lips in a unanimous shout of 'Long live Spain!' which rose spontaneously from those noble hearts.

"The casualties during the whole march were 1 colonel, 2 officers, and 68 privates wounded and 27 killed. Twenty-eight thousand six hundred and seventy Mauser cartridges had been used and 38 rounds of artillery fired.

"At 10 o'clock the last rear guard entered the city of Santiago de Cuba, and the battalions at once repaired to the different trenches assigned to them by the chief of staff, and from that time on they formed part of the forces defending the city.

"Santiago de Cuba, July 3, 1898."

The column went to occupy the following positions:

Canosa: Lieutenant Colonel Baldomero Barbón at the most advanced point; the Alcántara battalion which relieved the Asiatic battalion.

Match factory: The Isabel la Católica regiment, under Commander Luis Torrecilla.

Campo de Marte: The other battalion, under Commander Eugenio Briceño.

Dos Caminos del Cobre: The Puerto Rico chasseurs, under Lieutenant Colonel Arana.

Plaza de Toros: The Andalusia battalion, under Commander Julián Llorens.

9th.—The Alcántara battalion was relieved from the difficult position it occupied by six companies of the Isabel la Católica regiment, one of the Asiatic regiment, one company of guerrillas, all under the command of Lieutenant Colonel Barbón. On the morning of the 10th this line was reënforced by two companies of the Alcántara battalion.

10th.—The Puerto Rico chasseurs receded to the city.

XXXI.—In the City and in the Bay.

July 5th.—The usual ships blockading the harbor.

The greater part of the population has left the city, fleeing from the bombardment.

The merchant steamers are firing up.

The Morro says that there are 28 merchant and war vessels in sight. The Oregon and Brooklyn are missing.

In the city the streets are deserted and nearly all the houses locked up.

6th.—The two 9-cm. Krupp guns at Punta Gorda were taken down to be installed in the precinct of the city.

A German warship was signaled to the south.

Mr. Mason, with a flag of truce, went out in the tug Colón to communicate with her. When he arrived at the mouth of the harbor the ship had already left.

At 5 General Toral was advised by General Shafter that the suspension of hostilities was at an end.

Lieutenant Hobson, of the Merrimac, and the seven men were exchanged.

In the American fleet there are 1,100 Spanish prisoners, among them over 300 wounded.

7th.—It was learned that the prisoners of our fleet are being sent to the United States.

The two 42-centimeter guns of the Méjico were disembarked for the purpose of being erected in the precinct of the city. Forty Mauser guns were also taken off the ship. They could not be set up.

8th.—The hostile fleet continues the blockade.

Orders were given by the comandancia de marina to the captains of the merchant steamers to sink their ships.

A private house was prepared to receive the sick and wounded of the fleet. The convalescents were sent to the quarters of the firemen.

9th.—The hostile fleet in sight as usual.

Order of General Toral to have the merchant vessels refill their bunkers at the piers of Las Cruces and the Railway.

The wounded and sick of the fleet were transferred from the Méjico to the house fitted out for a hospital by the Navy.

On the 4th General Shafter notified the consuls that the city would be bombarded, so that all those might leave who did not form part of the garrison. At their request for more time in order to take away their families, the term was prolonged twenty-four hours.

The panic became general, and at daybreak of the 5th the population almost en masse left in the direction of Caney, so as to avoid a bombardment which all supposed would be horrible and not leave one stone upon the other.

The steamers, full of people, were ready to proceed to Las Cruces, Cinco Reales, and all the coves on the eastern coast of the bay, where they thought they would be better protected and safer.

All along the coast regular camps were established within the shelter of the mountains. It may be safely said that there were not 5,000 inhabitants left in the city. All the windows and doors were closed, and Santiago presented the same aspect that Pompeii and Herculaneum must have offered. Not a single store was open, not even the drug stores. The desertion and solitude were complete.

A few horses were running through the city, pulling up the grass growing along the sidewalks. Many dogs are staying at the entrances of the houses, which their masters have abandoned, without having anything to eat, nor anything to drink, which is worse. At night they bark incessantly, which makes the scene still more impressive. I have several times gone from the captaincy of the port to the military hospital, that is, across the city from one end to the other, without seeing a single door open or meeting a single person in the streets or public places, except a guerrilla or one or two couples of the civil guard. The solitude and the silence were absolute.

At night the city was truly impressive. The streets, the lamps not being lit, were as dark as wolves' dens, and it was not possible to cross them without being in constant danger of stumbling. A few guerrillas, taking advantage of the circumstances, were breaking into abandoned stores and houses, which they ransacked; for instance, the house of my friend, Commander Ros, governor of the Morro, situated in San Tadeo street, which I saw with my own eyes. They left nothing whole, and him only with the clothing he wore and 20 pesos which he had with him. The criminals, who were caught in the act, were four guerrillas. I speak with a perfect knowledge of what happened, and, as will be seen, I cite examples of well-known persons.

There is no excuse for such actions, and I shall not try to extenuate them; but it is also just to say, in honor of the truth, that the soldiers, who had hardly anything to eat and little water to drink, and who spent day and night in the trenches, were not to be found in the city, and when on rare occasions one would go there to see whether he could not get a glass of water or buy a box of sardines or a piece of hardtack, which the merchants were hiding, the latter asked him six times what it was worth, and fleeced him (I find no other word for it) without shame or compassion.

I must also add that such abuses, which were repressed as soon as they were commenced—thanks to the civil guard and patrols, who walked through the city day and night—were not committed by the troops, except in isolated cases, as in that of Mr. Ros. They were committed by citizens, although they were imputed to those who knew how to enter the houses without forcing the principal door. I might cite a thousand examples which would convince the most incredulous and which I omit for the sake of brevity. Thanks to the energy displayed by General Toral, the street lamps were finally lighted, so that it became possible to venture into the streets at night. As a proof of the proportions which this plundering reached, I will copy a decree which the General found it necessary to promulgate. The decree was as follows:

"I, José Toral y Velazquez, General of Division, Commander General of the Division of Santiago de Cuba, and Military Governor of the City and Province,

"In view of the frequent robberies which are being committed in this city, by reason of the peculiar circumstances in which it finds itself, in order to repress them, and by virtue of the authority vested in me under Article 670 of the Campaign Regulations, issue the following:

"DECREE.

"Article 1. All soldiers who, in disobedience of this decree, shall destroy or set on fire buildings or property, or commit any acts of violence on persons, shall be punished by confinement in the penitentiary for life, after previous degradation, in conformity with Article 239 of the Code of Military Justice.

"The penalty of death shall be imposed upon the instigators, or persons employing soldiers for this purpose.

"Criminals caught in the act of committing these offenses shall be summarily judged in conformity with Article 649 of the Code of Military Justice.

"Article 2. Civilians who shall commit the same offenses shall be adjudged in conformity with the Civil Code in force in this island, and the law shall be applied in its whole rigor by the respective Council of War.

"Article 3. Any one surprised in the act, who shall not give himself up at the first intimation, shall be fired upon.

"José Toral.

"Santiago de Cuba, *July 16, 1898.*"

As it is my object to relate everything that happened at Santiago de Cuba, without omitting even the most insignificant events, so that an exact idea may be formed of everything, I must also state that, as I was told by Mr. Romero, captain of the civil guard, who was wounded at Caney on the evening of the 1st, where he had arrived in the morning to take charge of the military comandancia of that place, and taken prisoner by the Americans, he was nursed, attended, and treated with all the attention due to his rank and condition, as also others who were in the same case. This proves that only the Government of the United States and the jingoes are the authors of the unjust war that is being carried on, but not the people in general, and still less the Army, which, as its own officers and soldiers have assured me, is desirous of having it terminated as soon as possible.

XXXII.—Battles and Bombardments of the 10th & 11th.

July 10th.—The usual ships opposite the harbor. The general staff of the fourth army corps has asked for a statement as to the personnel and armament of the navy, which was forwarded to him.

General Shafter gave notice that hostilities had again broken out since 4 in the afternoon.

At 3 the hamlet of Dos Caminos was burned.

At 5 a gunshot was heard which had been fired by the fleet; immediately after a sustained musket fire, which became very intense.

The artillery on land is firing, ours is answering.

At 5.15 the fleet opened fire on the coast.

At 6.30 the firing ceased by sea and by land.

The enemy has abandoned two trenches.

11th.—The fleet is guarding the harbor and Aguadores.

At 6 a slow musket fire commenced on land; a few volleys are heard.

At 8.30 two ships opened fire on the city from Aguadores. A few projectiles fall at the head of the bay, where the Alvarado is at anchor.

During yesterday 46 wounded were received at the military hospital. There were seven dead.

At 2 p. m. the bombardment ceased.

At 2.30 firing ceased in the precinct.

At 5 the enemy hoisted a flag of truce on the Fort San Juan.

At night many fires were seen on the heights near the cemetery and at the head of the bay (to the northwest).

The gunboat Alvarado asked for permission to fire; it was denied on account of the truce.

On the 10th the enemy, already in the trenches and being in possession of all the adjoining heights where he has installed numerous modern guns, opened a lively musket and gun fire, at 5 p. m., upon a great extent of our line. The artillery answered firmly, but there was hardly any musket fire, because orders had been given and complied with to economize ammunition at any cost.

Two hours previously, our advance forces had withdrawn to the city, abandoning the foremost position at Dos Caminos del Cobre, first setting it on fire.

The fleet at the same time opened fire on Aguadores and surrounding points on the coast, and on our lines. The battle was limited to firing from the trenches. Nevertheless, as the enemy was very numerous and his lines only a few meters from ours, we had 7 dead and 47 wounded. During the engagement the Americans abandoned two trenches which they could not hold because they were flanked by ours.

At 8.30 the following day the fleet bombarded the city from Aguadores, having given notice to that effect as early as the 4th. As I said, the ships of the fleet, taking turns two by two, fired rather slowly, and only until 2.30 p. m., but notwithstanding, there were 59 houses that suffered considerable damage. One shell went through a foundation in San Basilio street, where it dropped and exploded, and a shell cut an iron column of a provision store in two, penetrating into a house in Marina street, after piercing the wall. Another shell penetrated at No. 9 Santa Lucia High street, destroying the hall and one room. In the provision store of Messrs. Brauet, in Fundicion street, two 20-meter shells (nearly all were of this caliber, or of 16 centimeters) fell; one only exploded, causing great havoc. The most remarkable case of all was Mr. Marcané's house, in Santo Tomas Place. A single shell ruined it completely. It is hard to understand how a single projectile can do what that one did.

Between the garden of the Alameda and the railway station, being a distance of about 800 meters, 23 projectiles fell. Many of them did not explode. One of them went through a tree, as though it had been a gimlet. At the ice factory two fell, and three at the railway station. A great many fell near the piers, and still more near the place where the gunboat Alvarado was at anchor.

As the city was almost abandoned, there was no loss of life.

In the meantime the enemy continued to antagonize our lines in order to compel the soldiers to consume the scant ammunition that remained, but orders had been given not to answer the fire, and so there was hardly any musket fire. Gun fire only answered very slowly, as is necessary with antiquated guns. The enemy, on the other hand, was constantly receiving modern guns and setting them up rapidly. We were within a circle of fire, and although that phrase has been somewhat abused, I find no other that better describes the situation.

At 5 p. m. the enemy hoisted a white flag on Fort San Juan and a spokesman was received.

Though this may not be the right moment, I want to make an observation. It has been asked many times why Admiral Cervera's fleet, whose object was to run the blockade and elude the hostile fleet, did not go out at night.

Of course, the Admiral did not tell me his reasons, but it is easy to understand them.

The hostile fleet was constantly watching the entrance of the harbor with its search-lights, making it as light as though it were day. There the ships would probably have been seen just the same. On the other hand, the sortie, which even in daytime is extremely difficult, would have been short of impossible at night, when blinded by the search-lights, and would necessarily have resulted in a catastrophe. The sortie at night was impracticable. It was absolutely necessary to effect it in the daytime; at least, if the enemy saw us, we also saw him, and the chances for not running aground in the channel were much better. From the foregoing, I believe that any one, even though not acquainted with naval matters, will understand why Admiral Cervera did not go out at night.

As a proof of this, I will say that on the night when the cruiser Reina Mercedes was sunk the hostile ships fired upon her with the same accuracy as though it had been daytime.

For a better understanding of the events and engagements of the 10 and 11th of July, I will copy below the official report of Lieutenant Colonel Barbón and that of Lieutenant of Artillery Moreno to General Escario, as also a statement of the shots which our guns fired during those days. One need only glance at the statement referred to to see at once that on the first day 167 shots could be fired, and the next day, being the 11th, only 35, because the enemy had dismounted and disabled some of our guns. A simple calculation is sufficient to understand that the following day not a single gun could probably have been fired. Before such proofs, comments are unnecessary.

"Having been placed in charge of the forces on the right hand of the plantation called El Sueño, on the heights and in the glens which border on the avenues of Caney and Canosa, and the roads of Pozo and San Juan, composed of six companies of the Isabel la Católica Regiment, two of the Alcántara Battalion, one of the Asiatic Battalion, and one of guerrillas as stretcher-men, I have the honor to report to you that at 4.30 a. m. yesterday the enemy opened machine-gun and musket fire on our positions, without daring to make any forward movement; such prudence being founded, no doubt, on the respect inspired by our sepulchral silence before the thunderous noise of their many guns, for only 10 marksmen, in convenient positions, had orders to fire on a trench which they attacked on the flank and dislodged at the end of 15 minutes. At nightfall, 7.30 p. m., the enemy ceased firing.

"To-day, at 6.30 a. m., the enemy again opened fire, while our side did not waste a single cartridge, the enemy continuing with the same activity as yesterday, without coming out of his trenches, until 4.30 p. m., when he ceased firing and asked for suspension.

"The casualties on our side were, on the 10th, 6 dead and 29 wounded, and to-day, one dead, 5 wounded, and one bruised; total casualties during the two days, 42.

"You will see from the above that I have exactly complied with your orders not to fire until the enemy should come out of his trenches to attack.

"I only need add that all the forces without exception did their duty as brave men, full of enthusiasm, and I had to recommend repeatedly that they should conceal in order to avoid needless casualties, which seemed difficult, and there is nothing strange about it, as our men, for the first time in three years of campaign, were enclosed in trenches and on the defensive.

(Here follow special recommendations for bravery of three officers, being 1 commander and 2 lieutenants.)

(Signed) "BALDOMERO BARBÓN."

"SANTIAGO DE CUBA, *August 11, 1898.*"

Copy of the report made by the first lieutenant in charge of the artillery of the sector:

"ARTILLERY, CITY OF SANTIAGO DE CUBA,
SECTOR FROM THE PORTILLO DEL CANEY TO SAN ANTONIO.

"HONORED SIR: Fire was opened by the enemy yesterday at 4.45 p. m., and the batteries of this sector made it their business to silence it, or at least diminish it as much as possible, given the limited effectiveness of the guns which formed them—most of them muzzle-loading—and the reduced caliber of the only four which are of modern types, and can therefore keep up an accurate and rapid fire. The enemy's batteries, as has been observed on previous days by means of glasses, and as we have experienced practically to-day, are quite numerous, very well installed without leaving any space uncovered, and occupy positions overlooking ours, and are for that latter reason well adapted to train successfully, and to be of great moral effect on our troops, who are harassed almost vertically by the grapeshot (shrapnel?) inside the trenches. The guns of these batteries are of small and medium caliber, as may be seen from the size of their projectiles, and the shape of the latter shows that they are breech-loading guns, and for that reason alone, of the greatest advantage over ours. A few fire dynamite projectiles, but it was noticed that they are of little accuracy, although very effective when they explode. At the same moment when the musket and machine-gun fire was opened, which was hardly answered from the city, gun fire also commenced, and as the effect of the shells began to be felt at the first shots, it became necessary for us to do what we could to decrease the cannonade. Firing was commenced on the whole sector at the same time and with such rapidity as each gun permitted, except the Plasencia guns, for if we had continued to fire them with the same rapidity as the gunners, anxious to injure the enemy, had commenced, we would have consumed the whole of the ammunition in two hours. All the shots were made under the action of a constant musket and machine-gun fire, aimed particularly at the batteries, for the apparent purpose of not allowing us to come out of the trenches to load and train our guns. In view of the sustained artillery fire from the city the enemy moderated his somewhat, especially in the sector between Nispero and San Antonio, and by 6 p. m. the only guns that were doing any firing worthy of mention were those installed opposite the Portillo del Caney. This circumstance was very favorable for us. The ostentatious artillery fire which we did during the first moments checked the enemy's rapid fire along the greater part of the line, and if this had not been the case we should have been compelled to keep silent before his batteries, for of the 12 guns of different calibers of the batteries of Nispero, Sueño, Santo Inés, and San Antonio, we had left at the hour mentioned only three 8-cm. and two 16-cm. guns; the others had been put out of action, the carriages of most of them having been disabled. The batteries of Portillo del Caney continued to answer the fire, which was aimed at them particularly without a moment's cessation, and in one of them I was an eye witness of an incident worthy of mention. A training gunner of one of the 8-cm. Plasencia guns, whose captain had been previously wounded, was shot through one arm, and he continued to train, for fear that there would be no one to relieve him, until, a relief having been effected, he was obliged to go to the nearest hospital. At the same moment an artillerist came out with a mule and ran in the direction of the headquarters at Concha, passing through the musket and machine-gun fire, shouting, 'Long live Spain!' through the streets. He was on his way to get another supply of common shells for the gun, its supply having been consumed during the first shots. These incidents, and similar ones which no doubt occurred all along the line and in the trenches, show, honored General, that while the enemy had succeeded, owing to the superior position of his batteries, in acquiring greater accuracy of fire, he had not been able to quell the courage of our soldiers, always cool-headed before the greatest danger, even to the very last moment.

"At 7 p. m. the firing ceased, leaving us in bad condition for to-day, because, as I have already stated, only two 16-cm. and three 8-cm. guns, and two 8-cm. Plasencia, and two rapid-fire Krupp guns, are all that are available for the defense, and the majority of the mounts for the old ones are somewhat defective. * * *

"At 5.30 a. m. to-day fire was opened by a few musket shots, and a few minutes after the artillery battle commenced. The batteries with which the enemy fired yesterday are not the only ones he has; he also has large-caliber guns, or perhaps howitzers, which, being installed at a considerable distance from the city and covered by the hills, keep up a constant fire upon us, which we are not able to answer. Yesterday we could distinguish the flashing from the batteries erected between the Portillo del Caney and San Antonio, and to-day we can see only three opposite the said Portillo; the others were firing completely under cover, and we were not even able to disturb the composure with which they were trained. It is known that we did them some damage yesterday, and that is perhaps the reason why they have taken this position to-day. Only two shots were fired in the morning at Santa Inés and two more at San Antonio. And the rest of the day we have been able to fire only from the 8-cm. Plasencia battery and the 7.5 rapid-fire Krupp battery, erected at the Portillo del Caney and Palomar, respectively, which had opposite them three 9-cm. batteries of the enemy at a distance of 1,100 meters from the former and 1,600 meters from the latter. From the first moment it could be seen that the enemy's objective was to bombard the city, and his fire was aimed entirely at that target. Yesterday they took the exact distance from their batteries to the principal points of the city, and to-day, making use of yesterday's notes, they put the shells just where they wanted, and the trajectories of those from the same battery were almost identical. I repeat that there were only three in sight, and upon these three we opened fire at 6 a. m. with the rapid-fire guns. When the first shot was discharged the enemy partly changed his objective, and soon the battery mentioned and one of the hidden ones aimed their fire at Palomar, but were not able to hit the rapid-fire guns until 10 a. m., because these guns, being of reduced dimensions, in sunken battery, and with hardly any smoke from the discharge, were hardly visible to the enemy. For four hours we fired without knowing where we were, but very slowly, because the number of ordinary shells and grapeshot for the guns referred to is already very small. After these first four hours were over, the enemy answered each shot with 8 or 10 of his, which, with almost mathematical precision, were aimed at the battery. About the same thing, but on a greater scale owing to the proximity of the opposing batteries and the good target formed by the smoke which developed at each shot, happened at the Plasencia guns. Since 8 o'clock in the morning, when the fire was opened, until 3 in the afternoon, the places where the guns were erected were veritable centers of impact, since we had only two batteries and the enemy a great many. And when a shot was fired, all concentrated their fire on the one that had discharged. In order to fire at all, it was necessary to make the enemy believe, by using artificial means, that the gun had been put out of action. When this did not succeed, the gun fire aimed at the battery was incessant, and made it impossible for us to load and train. As I have stated, at 3 p. m. the firing ceased, and yesterday as well as to-day I noticed the greatest order among the officers and men in charge of the different batteries. At the Plasencia guns, the second gunner, Antonio Escriba Escriba, belonging to the 2d section of the 1st battery of the 5th Mountain Regiment, was wounded. The total number of shots fired yesterday and to-day is as follows: 16, with the rapid-fire guns; 33, with the 8-cm. Plasencia guns; 29, with the 8-cm. guns; 63, with the 8-cm. short breech-loaders; 10, with the 16-cm. and 10 with the 12-cm. bronze guns.

"May God guard your excellency for many years.

"JUAN MORENO,
"*First lieutenant,*
"*Commander of artillery of the sector.*

"SANTIAGO DE CUBA, *July 11, 1898.*"

The guns which the Americans had in the batteries of the circle, were all of modern type, with calibers of 8, 9, 7, and 7.5 cm. They fired mostly grapeshot (shrapnel?) with 10 per cent ordinary shells. They also made use of dynamite shells, but the number of these projectiles did not exceed 5 per cent of the total number thrown upon the city.

The batteries that were most persistent in firing on the 10th were those erected in the vicinity of the Caney road, and they fired only about 150 shots, with an average rapidity of 14 or 16 shots per hour and battery. The others, which ceased firing an hour earlier, discharged about 100 shots.

On the 11th the gun fire was more sustained, but slower. All the batteries fired about alike and discharged in all about 700 shots.

BATTERIES OF THE PRECINCT OF THE CITY OF SANTIAGO DE CUBA.

Batteries and guns.	No. of shots. 10th.	11th.
Fuerte Nuevo:		
One 12-cm. muzzle-loading bronze gun	1	..
Cañadas:		
One 16-cm. muzzle-loading bronze gun	2	..
Santa Ursula:		
Battery No. 1: Two 8-cm. muzzle-loading bronze guns	10	..
Battery No. 2: Two 8-cm. long muzzle-loading bronze guns	8	..
Battery No. 3: Two 9-cm. long muzzle-loading bronze guns	16	6
Portillo Caney:		
Battery No. 1: Two 8-cm. short breech-loading bronze guns (Plasencia system)	25	10
Battery No. 2: Two 8-cm. long muzzle-loading bronze guns	24	..
Nispero:		
Battery No. 1: One 16-cm. muzzle-loading bronze gun	1	..
Battery No. 2: One 12-cm. muzzle-loading bronze gun	2	..
Battery No. 3: Two 8-cm. short breech-loading bronze guns	30	..
Sueño:		
Battery No. 1: One 16-cm. muzzle-loading bronze gun	3	..
Battery No. 2: One 12-cm. muzzle-loading bronze gun	2	..
Battery No. 3: Two 8-cm. short breech-loaders	25	..
Santa Inés:		
Battery No. 1: One 16-cm. muzzle-loading bronze gun	2	2
Battery No. 2: One 12-cm. muzzle-loading bronze gun	4	..
Battery No. 3: Two 8-cm. short breech-loading guns	10	..
San Antonio:		
One 16-cm. muzzle-loading bronze gun	2	1
Palomar:		
Two 7.5-cm. short breech-loading rapid-fire Krupp guns	..	16

During the firing on the 10th, the following guns were put out of action: The gun of the battery of Fuerte Nuevo; one of each of the Santa Ursula batteries; the two of battery No. 2 of the Portillo del Caney; those of the Nispero batteries Nos. 2 and 3; those of batteries Nos. 1 and 2 and one of battery No. 3 of Sueño; and that of Battery No. 2 and one of Battery No. 3 of Santa Inés.

To sum up, there were disabled: four 12-cm., one 16-cm., eight 8-cm. guns, old systems, and one 9-cm. breech-loader.

The 9-cm. gun was disabled by the enemy, as also one of the 12-cm. guns of Sueño, the cause being that the 12-cm. guns were mounted on "skeleton" carriages that did not belong to them, and broke at the first or second shot, and that the 8-cm. old guns, although mounted in their own carriages, these being of wood and in bad repair, they had the same fate as soon as a few shots were fired. The 16-cm. gun was disabled by the cartridge sticking in the chamber.

XXXIII.—Suspension of Hostilities.

July 12th.—The hostile fleet is still in sight.

The archbishop, escorted by a detachment of the mounted civil guard, left the city, returning soon after.

General Linares has forwarded to the commander-in-chief and to the minister of war the following cablegram, which I copy literally:

"OFFICIAL CABLEGRAM, JULY 12.

"To the commander-in-chief and the minister of war:

"Though confined to my bed by great weakness and sharp pains, I am so much worried over the situation of these long-suffering troops that I deem it my duty to address your excellency and the minister of war for the purpose of setting forth the true state of affairs.

"Hostile positions very close to precinct of city, favored by nature of ground; ours spread out over 14 kilometers; troops attenuated; large number sick; not sent to hospitals because necessary to retain them in trenches. Horses and mules without food and shelter; rain has been pouring into the trenches incessantly for twenty hours. Soldiers without permanent shelter; rice the only food; cannot change or wash clothes. Many casualties; chiefs and officers killed; forces without proper command in critical moments. Under these circumstances, impossible to open passage, because one-third of the men of our contingent would be unable to go out; enemy would reduce forces still further; result would be great disaster without accomplishing the salvation of eleven much-thinned battalions, as desired by your excellency. In order to go out under protection of Holguin division, it would be necessary for the latter to break through the hostile line, and then with combined forces to break through another part of the same line. This would mean an eight days' journey for Holguin division, bringing with them a number of rations which they are unable to transport. The situation is fatal; surrender inevitable; we are only prolonging the agony; the sacrifice is useless; the enemy knows it, fully realizing our situation. Their circle being well established, they will exhaust our forces without exposing theirs as they did yesterday, bombarding on land by elevation without our being able to see their batteries, and from the sea by the fleet, which has full advices, and is bombarding the city in sections with mathematical accuracy.

"Santiago de Cuba is not Gerona, a city inclosed by walls, on the soil of the mother country, defended inch by inch by her own sons, by old men, women, and children without distinction, who encouraged and assisted the combatants and exposed their lives, impelled by the sacred idea of independence, while awaiting aid which they received. Here solitude, the total emigration of the population, insular as well as peninsular, including public officials, with a few exceptions. Only the clergy remain, and they intend to leave to-day headed by their prelate.

"These defenders are not just beginning a campaign, full of enthusiasm and energy; they have been fighting for three years with the climate, privations, and fatigue; and now that the most critical time has arrived their courage and physical strength are exhausted, and there are no means for building them up again. The ideal is lacking; they are defending the property of people who have abandoned it in their very presence, and of their own foes, the allies of the American forces.

"There is a limit to the honor of arms, and I appeal to the judgment of the Government and the whole nation; for these long-suffering troops have saved that honor many times since the 18th day of May, when they sustained the first bombardment.

"If it should be necessary to consummate the sacrifice for reasons which I ignore, or if there is need of some one to assume the responsibility of the *dénouement* anticipated and announced by me in several cablegrams, I offer myself loyally on the altar of my country for the one purpose or the other, and I will take it upon myself to perform the act of signing the surrender, for my humble reputation is worth very little when it comes to a question of national interests.

"LINARES."

13th.—The ships are still blockading the harbor.

By order of the commander of marine, I went to the cruiser Reina Mercedes in order to ascertain her exact position.

In crossing the channel we saw two hostile ships, but at a great distance.

The cruiser which I visited is aground on the Morro shore. The port side is completely under water, the starboard side above water; here the effects of the hostile shells may be observed. She lies in the line of the channel, and therefore does not interfere with the entering or going out of ships. I do not believe that the enemy will be able to use her; besides the injuries caused by the shells, the sea has commenced to destroy the bottom.

Upon returning I saw and spoke to many volunteer officers who have taken refuge there, dressed in civilians' clothes.

The conferences with the enemy have come to nothing, and it was decided that the suspension of hostilities and the armistice should cease and the bombardment be continued.

The sailors from the fleet, 98 in number, who were at the firemen's headquarters, have gone, under the command of Ensign Gómez, to protect the match factory near the gasometer.

There was a suspension of hostilities during the days of the 12th and 13th, and conferences were held with the enemy, which evidently have come to nothing, and from General Linares's eloquent cablegram, setting forth so graphically and accurately the true state of affairs in this unfortified city and the situation of its defenders, it may be inferred that the capitulation was objected to, although it was absolutely necessary and further resistance impossible.

14th.—The chief pilot of this harbor, Apolonio Núñez, was taken prisoner by the insurgents at Renté, situated west of the bay. The commander of marine at once notified General Toral, and as the suspension of hostilities had been extended, the latter, in his turn, advised General Shafter, commander-in-chief of the American forces operating at Santiago.

15th.—Pilot Núñez was delivered up and escorted to the city by American soldiers.

At night the chiefs of the army assembled in the apartments occupied by the staff of the division, and as a result of the meeting the following memorandum was drawn up:

"On the 15th day of July, 1898, in the city of Santiago de Cuba, the following-named persons assembled, previous notice having been given of such meeting: General of Division José Toral y Velázquez, for the time being commander-in-chief of the fourth army corps, as president; General of Brigade Federico Escario; Colonel Francisco Oliveros Jiménez, of the civil guard;

the following lieutenant colonels of the different battalions: José Cotrina Gelabert, of the Asiatic battalion; Juan Puñet, of the battalion 'Constitucion;' Pedro Rodríguez, of the Talavera battalion; Ventura Fontán, of the staff; Baldomero Barbón, of the Alcántara battalion; Segundo Pérez, of the San Fernando battalion; José Escudero, of the provisional battalion of Puerto Rico No. 1; Luis Melgar, of the artillery; and Ramón Arana, of the Puerto Rico chasseurs; Julio Cuevas, commissary of war; Pedro Martin, sub-inspector of the medical department of the army, and Juan Díaz Muelas, captain of engineers, all as voting members, and the last named as secretary.

"The president stated that although he did not consider Santiago de Cuba a stronghold of war, and though he was in direct communication with the commander-in-chief, from whom he received precise instructions, so that it was not necessary to proceed to the convocation of the council of defense referred to in Article 683 of the Regulation of Campaign, he desired nevertheless to learn the opinion of said council, constituted in accordance with the provisions of the regulation referred to, and of the lieutenant colonels of the battalions, as to whether, in view of the condition of the forces defending the city, it would be advisable to prolong the defense, or, on the contrary, to capitulate on the most favorable terms obtainable.

"The junta, considering that Santiago has no other works of defense of a permanent nature than a castle without artillery at the mouth of the harbor and a few forts in the precinct, none of them substantial, so that its only real defense consists in the trenches which have been dug in suitable positions in the circuit of the city, and other earthworks in said circuit and in more advanced positions, all effected hurriedly and with scant resources;

"Considering further that for the defense of this line of trenches, about 14 kilometers long, not continuous, there are available only about 7,000 infantry and 1,000 guerrillas, all of whom have been doing constant service in the trenches, with hardly any troops to support them and without any reserves of any kind, the rest of the forces (the total forces consisting of about 11,500 men), belonging to other arms and garrisoning the Morro and the batteries of Socapa and Punta Gorda, or being assigned to other services, such as supplying all the posts with water, patrolling the city, etc., which service would have been rendered by the inhabitants if the city had remained loyal, but which must now be performed by the army, the inhabitants having abandoned the city;

"Considering further that, in view of the great extent of the line referred to, the position of the forces on the same, the difficulty of communication and the proximity of the hostile positions to ours, it is difficult for the troops stationed at one part of the line to render prompt assistance to those stationed at another part which might be more seriously threatened;

"Considering further that at the present time the only available artillery of the precinct consists of four 16-cm. rifled bronze guns, one 12-cm., one 9-cm. bronze gun, two long 8-cm. rifled bronze guns, four short ones of the same caliber, two 8-cm. Plasencia and two 75-mm. Krupp guns; that the 12 and 16-cm. guns, according to reliable information, are about to give out and will admit of only a few more shots, and that the 75-mm. Krupp guns have hardly any ammunition, and that the above is all the artillery we have to oppose to the enemy's numerous modern guns;

"Considering further that the million Spanish Mauser cartridges, being the total available, counting those at the artillery park and the spare cartridges of the troops, will be used up in two or three attacks made by the enemy; that the Argentine Mauser cartridges can hardly be used, and the Remington only by the irregular forces;

"Considering further that, owing to the failure of the commercial element to lay in supplies prior to the blockade which had long been foreseen, there is a great scarcity of meat and of all other articles of food for the troops, it being necessary to reserve for the military hospital the few heads of cattle now on hand, so that the only available food for the soldiers consists of rice, salt, oil, coffee, sugar, and whiskey, and this only for about ten days longer;

"Considering further that, if the food of the 1,700 sick at the hospital is inadequate, the food furnished the soldiers is still more so, and yet they have to spend night and day in the trenches, after three years of campaign, the last three months without meat except on rare days, and for some time past reduced to the rations above enumerated;

"Considering further that with such inadequate rations the soldiers, whose physical strength is already considerably shaken, far from being able to repair their strength, must necessarily become weaker every minute, especially since, in spite of their poor nourishment, the greatest fatigues are required of them;

"Considering further that there is an ever-growing contingent of soldiers among the troops who, though not in hospitals, are sick and who are enabled to remain at their posts only by their superior courage, which circumstances, however, cannot fail to weaken the resistance of the only line of defense we have;

"Considering further that, since the cutting of the aqueduct, great difficulties are experienced by the small forces available for furnishing water to the majority of the forces in the trenches of the precinct, especially those near the coast, which difficulties must naturally increase when the city is bombarded by sea and by land, so that there is well-founded fear that the soldiers who are unable to leave the trenches may find themselves without the water of which they are so much in need;

"Considering further that, in view of the location of the hostile positions, mostly in the immediate vicinity of ours, completely surrounding the city and in control of all the avenues, there is no possibility of abandoning the city without a fierce battle under the most unfavorable circumstances for us, owing to the impoverished condition of the soldiers and the fact that it would be necessary to effect the concentration of the forces in sight of the enemy;

"Considering further the great superiority of the enemy who, besides a contingent of men said to exceed 40,000, possesses 70 pieces of modern artillery and a powerful fleet;

"Considering further that no supplies can reach the city except by sea, and that there is no prospect of receiving any as long as a powerful hostile fleet completely closes the entrance of the harbor;

"Considering further that, under these circumstances, to continue so unequal a fight would lead to nothing except the sacrifice of a large number of lives;

"And considering, finally, that the honor of our arms has been completely vindicated by these troops who have fought so nobly and whose behavior has been lauded by our own and other nations, and that by an immediate capitulation terms could be obtained which it would not be possible to obtain after hostilities have again broken out:

"The junta is of unanimous opinion that the necessity for capitulation has arrived. In witness thereof they sign these proceedings."

(Signatures of members.)

XXXIV.—Capitulation.

July 16th.—The people have returned from Caney.

Negotiations for the capitulation having been opened, we think it proper to give the following important document:

"Neutral Camp near Santiago de Cuba,
Under the Flag of Truce, July 14th, 1898.

"Recognizing the nobleness, valor, and bravery of Generals Linares and Toral and of the Spanish troops who took part in the actions that have recently occurred in the vicinity of Santiago de Cuba, as shown in said battles, we, the undersigned, officers of the United States Army, who had the honor of taking part in the actions referred to, and who now constitute a committee, duly authorized, treating with a similar committee of officers of the Spanish Army for the capitulation of Santiago de Cuba, unanimously join in asking the proper authorities that these brave and gallant soldiers may be granted the privilege of returning to their country carrying the arms which they have so nobly defended.

(Signed) "Joseph Wheeler,
Major General U. S. V.
"W. H. Lawton,
Major General U. S. V.
"J. D. Miley,
First Lieutenant, Second Artillery, Aide."

Under a giant cotton tree the following capitulation was signed:

"1st. The hostilities between the Spanish and American forces shall cease absolutely and finally.

"2d. The capitulation shall include all the forces and war material in said territory (territory of the division of Santiago).

"3d. The United States agree to transport all the Spanish forces in said territory to the Kingdom of Spain with the least delay possible, the troops to be embarked, as early as can be done, at the nearest ports they occupy.

"4th. The officers of the Spanish army shall be permitted to carry their arms with them, and officers as well as men shall retain their private property.

"5th. The Spanish authorities agree to raise, or assist the American Navy in raising, all the mines and other obstructions to navigation now existing in the bay of Santiago de Cuba and its entrance.

"6th. The commander of the Spanish forces shall deliver, without delay, to the commander of the American forces, a complete inventory of the arms and munitions of war in the district above referred to, as also a statement of the number of troops in the same.

"7th. The commander of the Spanish forces, upon leaving said district, shall be authorized to take with him all the military archives and documents belonging to the Spanish army now in said district.

"8th. All that portion of the Spanish forces known as volunteers, mobilized troops, and guerrillas who may desire to remain in the Island of Cuba shall be allowed to do so, on condition that they will deliver up their arms and give their word of honor not again to take up arms against the United States during the continuation of the present war with Spain.

"9th. The Spanish forces shall leave Santiago de Cuba with honors of war, afterwards depositing their arms at a place mutually agreed upon, to await the disposition which the Government of the United States shall make of them, it being understood that the United States Commissioners shall recommend that the Spanish soldiers be permitted to return to Spain with the arms which they have so gallantly defended.

"10th. The clauses of the foregoing document shall go into effect immediately after having been signed.

"Entered into this 16th day of July, 1898, by the undersigned commissioners, acting under instructions of their respective commanders-in-chief, and with the approval of their respective governments.

"Joseph Wheeler,
Major General U. S. V.
"W. H. Lawton,
Major General U. S. V.
"J. D. Miley,
First Lieutenant, Second Artillery.

"Federico Escario,
Brigadier General.
"Ventura Fontán,
Lieutenant Colonel,
General Staff.

"Robert Mason, *Interpreter.*"

The reason why the archbishop went out of the city on the 12th was to ask General Shafter to permit him and thirty priests to leave Santiago. The American general refused to grant this request as long as the negotiations were pending.

XXXV.—The Emigration to El Caney.

I will here speak of a matter which, though not directly related to the military operations, nor the movements of troops, nor the attack or defense of positions, is yet so graphic and typical and so remarkable and far-reaching in the consequences which it entailed and still entails, that to omit it would be to omit one of the most important episodes of this eventful period, an episode that has been much commented upon and discussed. I have reference to what may well be called the emigration to El Caney.

At daybreak of July 5, a compact crowd, composed for the greater part of old men, women, and children, though strong, robust men—some of them volunteers, now in civilian's clothes—were not wanting, started from the city toward El Caney, about a league and a half distant, where they were going on foot, there being no carriages, nor wagons, nor vehicles of any kind, nor even horses, which the enemy, moreover, would not have allowed to pass. All these people were crossing the ditches and trenches by which the whole road was cut and obstructed, all anxious to escape from the dangers of a bombardment of which notice had been given to the consuls.

Many of those who emigrated were people of wealth, women not accustomed to such fatigues and hardships, which fear and terror alone enabled them to bear.

Being convinced, though I do not know why they should have been, that their absence would not be for more than sixty or seventy hours at most, the majority of them had nothing with them but the clothes on their backs and a little underclothing, and no provisions except what they could carry themselves.

I have been told, not by one person alone, but by many who were there and with whom I have talked, that there were no less than eighty people in any one house, and in some of them as many as two hundred. As in the cemetery, each person had no more space than he or she occupied; and thus they were housed together, men and women, children and old people, white persons and black.

The provisions which were calculated for three days at most were naturally soon exhausted, and this is probably the only instance in the nineteenth century when money was looked upon with disdain and when gold was of no value. Trading was going on, it is true, but it was exchanging rice for coffee, hardtack for beans, or sugar for codfish.

The bodies of those who had been killed on the 1st of July had only partly been buried, and the houses in that portion of the town which had been shelled were riddled with bullets and therefore leaking everywhere. Carcasses of horses and other animals, even corpses of persons, were thrown into the river, and people washed their dirty clothes and bathed in the water, which was all there was to drink. Most of the people lived on mangoes and mamoncillos, and it is no wonder that malaria, fevers, and dysentery broke out and assumed alarming proportions.

The houses had no sanitary provisions of any kind, and as the doors were kept closed in order to prevent new invasions, the atmosphere was terrible. The children, sick from lack of nourishment or from taking food which they could not digest, were crying day and night, and quiet or rest became impossible.

The faces of those who died were covered with a sheet or handkerchief, and the living remained by the side of the dead bodies, knowing that, if they should leave their places, others would come to occupy them.

Why go on? I might write a hundred chapters and still not give an idea of the suffering during those days; suffice it to say that El Caney, which was a town of 200 houses, was invaded by 20,000 people, who had counted on being there two days and who remained eleven, namely, until the 16th.

Those eleven days at El Caney have caused more victims in Santiago than the three years of war; for the epidemic that broke out still continues. When the inhabitants of the city numbered 45,000 there were, on an average, not over five deaths a day; and now, that the number of inhabitants is reduced to 30,000, there are not less than fifty a day. The house that does not contain one or more sick is an exception, and people who are well and hearty one day are buried a day or two later. The physicians cannot attend all the sick, and the dead are carried to the cemeteries by members of their own families. The city wears that stamp of sadness and absence of life which is the mark of great calamities, and we hear nothing but wailing and sobbing.

A bombardment of course, inspires women with the greatest horror, and yet, they preferred its dangers and consequences to the sadness and miseries of El Caney and asked, as the greatest of blessings, to be allowed to return to Santiago, and to that end they signed a petition drawn up by the British consul, Mr. Frederick Ramsden, a literal translation of which follows:

"We, the undersigned women, in the name and at the request of all the women and children who are staying in this town without food or shelter, set forth to your excellency as follows:

"At 3 o'clock in the afternoon of the 3d instant, the consuls of Santiago de Cuba were notified that your excellency intended to bombard the city the following day at 10 o'clock in the morning, unless the Spanish army should surrender by that time, and that your excellency had ordered that the women and children should leave the city prior to that hour.

"The same evening, at the request of the consular committee, your excellency consented to defer the bombardment until noon of the 5th, and it was agreed upon that the non-combatants should proceed to El Caney, Cuabitas, and other places on the line of railway.

"In conformity therewith, the civil governor of Santiago de Cuba issued a decree permitting all non-combatants to leave the following morning, between the hours of 5 and 9, on foot, and without vehicles or beasts of burden. Consequently, old and young, rich and poor, sick and invalid, went out in confusion, without extra clothing and with only the food they could carry themselves, fleeing from certain death, and firmly convinced that the city would be bombarded that same day, and that in two days they would be able to return to what might be left of their homes. Far from this being the case; it is now ten days since they came here; many are without a roof over their heads and the others housed together like hogs, without even having room enough to lie down on the floor, which is all the bed they have; the scant supply of food is exhausted and no more can be had at any price. The praiseworthy efforts of the army and of the Society of the Red Cross are inadequate to better the situation; they are perishing themselves of hunger; the old and the sick are dying for want of care and medicines and as a result of so much suffering. And still the city has not yet been taken or bombarded, except a partial bombardment last Sunday and Monday, by which no result appears to have been attained, nor does there seem to be any probability of a change in the horrible situation for the near future.

"They now invoke that same *humanity* which has been the *motive* of this war, to ask that something be done as soon as possible to put an end to this terrible state of affairs, or that arrangements be made with the Spanish authorities permitting us to return to the city, where we would rather die from the shells or be buried under the ruins of our homes than perish slowly from hunger and disease, and the privations we are suffering.

(Here follow signatures.)

"CANEY, *July 14, 1898.*

"To His Excellency GENERAL SHAFTER,
Commander-in-Chief of the United States Army."

This document, remarkable under all aspects, describes the situation better than anything that I might say.

XXXVI.—SURRENDER OF THE CITY.

July 17th.—In conformity with the terms of the capitulation, the surrender of the city to the American army took place to-day.

At 9 a. m. the Spanish flag was hoisted on Punta Blanca Fort and saluted by 21 guns; shortly after it was lowered.

At 9.30 Generals Toral and Shafter, commanders-in-chief of the Spanish and American forces, respectively, the latter accompanied by his staff and many of the commanders and officers of the American fleet, witnessed the marching by, under arms, of a company of the former, representing all the Spanish forces, as it was difficult to assemble them. The American forces presented arms and beat a march.

The heights of Conosa were the theater of this sad scene. The morning was very beautiful, and the clearness of the sky formed a singular contrast with the gloom that enwrapped the spirit of our troops.

When the march was ended, the American forces remained at their posts, while ours left the trenches and proceeded to the city for the purpose of depositing their arms.

The forces of the Socapa and Punta Gorda were taken by sea, in the steamer Reina de Los Angeles, to Las Cruces pier, and from there they marched to the Artillery Park, where they delivered arms and ammunition. Without them, they proceeded to the camp outside of the city, where all the forces were to assemble until the arrival of the vessels which, as agreed upon, were to convey them to Spanish soil. The other troops did the same thing, after depositing their arms at the points designated beforehand.

The troops having evacuated the city, 1,000 men of the United States Army entered it, hoisting the flag of that nation at the Palace and Morro Castle. It is the only flag that has been raised in the city. No insurgent forces, nor individuals belonging to the same, have entered the city with arms. The situation remained the same till the day when the army embarked for Spain.

As the operations at the Park lasted several hours, it was curious to see the avidity with which the Americans were looking for numbers worn by the 29th battalion (Constitución), sabres, buttons, and decorations of our officers and soldiers. It was noticed with what satisfaction they kept whatever articles and arms they could gather. Some of them put on the crosses, covered with dirt and blood, that had adorned the breasts of the Spanish. There were so many incidents on the same order that it would really be tedious to enumerate them. They showed the high conception which the American forces had of the valor of our army.

One incident, in conclusion, relative to this matter: When a Yankee officer of artillery and another of engineers took possession of the Morro, they inquired about the defenses and artillery of the fort. "There they are," said the governor, pointing to the land batteries and old guns. The American officers did not believe him; personally they went all over the place in search of guns and more important works of fortification. And when they had convinced themselves that they had been told the truth, they exclaimed: "That fleet" (pointing to Admiral Sapmson's) "has no excuse for not having gained possession of the harbor and defeated the city and its defenses in so many days." *

The Commander-in-Chief of the American Army is General Miles. (Here follow the names of the different commanders-in-chief of the United States Army and Navy.)

At 10 a. m., an officer of the American Army, delegated for that

* On July 2, Admiral Sampson wrote General Shafter: "It was my hope that an attack on your part of these shore batteries from the rear would leave us at liberty to drag the channel for torpedoes."—O. N. I.

purpose, took possession of the comandancia de marina and captaincy of the port, which were surrendered to him, after we had gathered up such documents and communications as should be preserved, and destroyed the others, or made them useless.

The forces are still depositing arms and ammunition, preserving excellent order, which has not been disturbed for a moment. Then they march to the camp outside the city. The arms were all deposited at the park, and not surrendered to the enemy. In order to form an idea, though only approximately, of the number of the forces defending the city, I give below a statement which gives the number at the hospitals, several having been fitted up.

On the 17th of July there were—

In the military hospital	800 sick and wounded.
At the Concha headquarters	500 sick and wounded.
At the Mercedes hospital	500 sick and wounded.
At Barracones	300 sick and wounded.
Total	2100 sick and wounded.

NOTE 2: At the hospital, only the seriously wounded and sick were admitted; those who could stand on their feet were refused and sent back to the trenches. If this had not been the case, there would not have been beds enough in which to put them nor physicians to attend them. Therefore, the number of sick was in reality much greater than shown by the statement furnished by the hospital.

The soldiers had but little to eat, and that little was bad, and not enough water. The latter was scarce, and means were lacking for transporting it to all the points on the extensive line they covered and which it was indispensable to maintain.

The horses of the cavalry, as well as the animals of the artillery and military administration, had had no corn to eat for a long time, and the hay, their only food, was very difficult to get and caused sickness, which was worse.

In conclusion, I will give a statement of the stock on hand which the artillery park turned over to the American officer commissioned to receive it:

ARTILLERY PARK OF SANTIAGO DE CUBA.

Statement of the stock on hand, in arms and ammunition, of which the officer of the American Army, commissioned to receive it, takes charge.

Kind.	Number of arms.	Rounds of ammunition.
Mauser guns, Spanish model, 7-mm., No. 1893	7,902	1,500,000
Mauser guns, Argentine model, 7.65-mm., No. 1891 Mauser guns, Turkish model, 765-mm., No. 1892	872	1,471,000
Remington guns, 11-mm., No. 71 Remington guns, 11-mm., No. 7189	6,118	345,000 1,335,000
Mauser carbines, Spanish model	833	1,200
Mauser carbines, Argentine model	84	
Remington carbines	330	
Revolvers	84	
Sabers	267	
Machetes	692	

SANTIAGO DE CUBA, *July —, 1898.*

LUIS MELGAR,
Lieut. Col., Commander of Artillery.

Found correct by the officer commissioned. Errors and omissions excepted.

A. D. BORUP,
Lieut. Col., U. S. V., Chief Ord. Officer.

It will be seen that nearly the whole armament with which the Spanish army was equipped consisted of Mauser guns, Spanish model (the Remington was that of the volunteers and a few mobilized companies); hence the ammunition for those was all that could be used and should be counted; the rest was useless. Therefore, the number of cartridges on hand and surrendered was 1,500,000, and the number of guns 7,902. Hence there were 191 cartridges for each soldier. Every army man will know the time it takes to use them up.

Here end the events and military operations that took place at Santiago de Cuba, and which are the subject of these notes. I should therefore stop here, but I do not wish to do so without venturing a few ideas suggested to me by certain scenes of which I was an unwilling witness (for I have naturally avoided sights in which there could be nothing pleasant), and without making a comparison between two sieges, upon one of which judgment has already been passed and which has become a matter of history known to every one, and upon the other of which judgment can not yet be passed because we are not as yet in possession of the necessary data and information which would make a just and impartial sentence possible.

I give below the official statement of all the casualties sustained by the forces of Santiago de Cuba in the different bombardments and battles from the 18th of May to the date of the signing of the capitulation. Those caused by sickness are not included.

CASUALTIES IN THE BOMBARDMENTS AND ATTACKS ON THE CITY OF SANTIAGO.

Date.	Killed.				Wounded.				Prisoners and Missing.		
	Generals.	Commanders.	Officers.	Men.	Generals.	Commanders.	Officers.	Men.	Commanders.	Officers.	Men.
June 6—Morro	....	....	....	2	....	1	4	25	....	....	....
Estrella	....	....	....	1	....	....	....	....	....	....	....
Cay Smith	....	....	....	....	....	....	....	2	....	....	....
Socapa	....	....	....	....	....	....	....	8	....	....	....
Mazamorra	....	....	...	....	....	....	....	11	....	....	....
Cruiser "Reina Mercedes"	....	1	....	5	....	1	1	10	....	....	....
June 14—Socapa	....	....	....	....	....	....	1	6	....	....	....
June 16—Morro	....	....	....	1	....	....	1	10	....	....	....
Socapa	....	....	....	2	....	....	1	6	....	....	....
June 21—Morro	....	....	....	....	....	....	....	3	....	....	....
June 22—Socapa	....	....	....	....	....	....	1	....	....	....	....
Aguadores	....	....	....	....	....	....	1	6	....	....	....
Daiquiri	....	....	....	1	....	....	....	5	....	....	....
June 23 and 24 } Sevilla	....	....	....	9	....	....	3	24	....	....	....
June 25—Aguadores	....	....	....	....	....	....	2	1	....	....	....
June 26—Morro	....	....	....	....	....	....	....	8	....	....	....
July 2—Morro	....	....	....	1	....	....	1	31	....	....	....
July 1, 2, 3 } Caney and Santiago	1	3	12	78	1	6	30	339	1	6	116
July 10—Santiago	....	....	....	6	....	1	2	45	....	....	....
July 11—Santiago	....	....	....	1	....	....	1	16	....	....	....
Total	1	4	12	107	1	9	49	556	1	6	116

RECAPITULATION.

	Generals.	Commanders.	Officers.	Men.
Killed	1	4	12	107
Wounded	1	9	49	556
Prisoners and missing	....	1	6	116
General total	2	14	67	779

XXXVII.—Traders, not the Spanish People.

I was sent to the Island of Cuba for the first time in 1868 and have remained there, if not constantly, yet quite long enough to understand, even though I am but a poor observer, that one of the most important causes which have led to the deep aversion which the sons of Cuba generally show for the mother country is the conduct of a certain number of people who come from the Peninsula with no other object in view than to accumulate a fortune in more or less of a hurry, the majority of them having no education or knowledge of any kind.

In order to better attain their desires and ambitions, they incessantly boast of everything Spanish, whereby they must necessarily come into conflict with the Cubans, whose feelings and dignity they hurt and offend. When they have acquired money, they aspire to lucrative and important offices, which they obtain because they are Spanish, to the prejudice of others, who by their intelligence and ability are better fitted to hold them; and the aversion is intensified into hatred, which, always latent, though concealed, was only waiting for an opportunity to break out openly. This opportunity presented itself for the first time in 1868, and the battle cry of Yara became the signal of vengeance and extermination, to which these Peninsulars responded by organizing the corps of volunteers.

To deny that they have since rendered important and constant services to the cause of Spain, would be both unjust and useless; but it must also be acknowledged that they have committed many serious errors, often becoming overbearing and having compelled more than one captain general to resign his command—a fatal example which hurt us in our country and impaired our reputation in other countries.

The first Cuban insurrection and all those which we have had to fight since have acquired that stamp of cruelty and extermination which is a characteristic of savage people, but not of civilized nations, and the war has given an opportunity to satisfy vengeances, which have given rise to reprisals and furnished the Government of the United States with a pretext—both unjust and hypocritical, as I know only too well, but still a pretext—for deciding on armed intervention, in the name of humanity, or which is the same, on war, which could not help but be its natural outcome.

If all those errors and offenses which have been attributed to Spain and the country had really been committed by them, such intervention would have been justified and even worthy of commendation. But events have shown very plainly that to them (the Peninsulars referred to) the nation was but a pretext and that the object was quite a different one, namely, the attainment of their aspirations and the realization of their desires. And this is further evidenced by the fact, previously mentioned, that, taking advantage of the scarcity of provisions, the natural consequence of the blockade, they hid such provisions as they had on hand or asked exorbitant prices for them, without any reason to justify such proceeding, after taking good care to place their funds abroad, in anticipation of what might happen. I need hardly state again that those who were so enthusiastic and loyal in normal times were the first to strip off the uniform and hide where they believed themselves safest. Finally, when they became convinced that the sun in whose light they had been living, and in whose rays they had thrived, was yielding his place to another sun, larger in size, but not in luster, they sought its protection and benefits, without remembering any longer the one which their eyes had seen when they opened them for the first time. "The King is dead—long live the King!"

They advertised their merchandise in "The Times," of Santiago de Cuba, a newspaper of recent publication, printed in Spanish for the information of the Cubans, the hatred of whom does not prevent their fleecing them, and in English for the purpose of doing the same thing with their new masters, whom they did not hesitate in recognizing. And so great is their love and affection for Spain, of which they were so proud, that where they ask one dollar of American silver they require two in Spanish coin of the same metal. They consider the latter worth one-half of the former. Perhaps this may seem exaggerated, the same as many other truths contained in my "Notes;" but a letter signed by a Peninsular, published in number 7 of said "Times," of Santiago de Cuba, of August 8, will convince the most incredulous. The following is a literal copy of the letter:

"EMIGRATION AT PRESENT IS FOLLY.

"Your southern race has many vices, but it also possesses great virtues. Its weak point is that it is extremely impressionable. Any orator speaking to you carries you completely away, and with childlike weakness you accept everything just as it is painted and described to you.

"During the six months last past the Spanish race at Santiago de Cuba has lived in this fictitious atmosphere; I say 'fictitious' because the bitter reality has not realized our patriotic and enthusiastic aspirations.

"How many useless sacrifices! How many illusions destroyed! But that should not discourage us, because history, when dealing with the events and the suffering of this poor people, will take good care to transmit them to posterity with impartial rudeness.

"At present, as long as we are acquainted only with the occurrences that have taken place in this province alone and know absolutely nothing of what is going on in the rest of the world, including our mother country, why do we not wait until the black clouds hanging over us have passed away and until the horizon has cleared up so that we may be able to judge of our true situation and decide what is to be done? Be calm, very calm, peninsular residents of this city; let us condemn right here the voluntary desertion which prejudices your sacred interests, and whose current you have followed without considering whether it would lead to your happiness or to your ruin. However much you may think about the extremes which I have just pointed out to you, it will still be little enough.

"Let us suppose for a moment that the dismemberment of our poor Spain becomes a fact, a thing which we do not know. What painful scenes are you going to witness? What business will you resort to to recover from the ruin of your interests? Unfortunately none, for your long absence will keep you in ignorance of everything, and the radical change of climate, when winter is almost at hand, will affect your health and that of your families.

"If you remain here, in this locality which is occupied by soldiers of a strong nation, until we shall learn definitely what has happened, you will lose nothing either in your business or your independence.

"The noble and farsighted chiefs who are at present ruling the destinies of this country have shown you plainly that all they wish is that peace and order may reign in all the branches of our public administration;

"That they have called upon you as well as the industrious Cubans to co-operate in the work of progress and social reconstruction;

"That they have neglected nothing in order that the inhabitants may have cheap and wholesome food;

"That they have established banks for the development of our agriculture and commerce.

"They have also shown us, and have so far proved it, that they have not come here in the interest of any faction or political party, but are desirous only of promoting the progress of this island and the well-being of its inhabitants.

"Since the situation which I have just described to you is the undeniable truth, why should you want to join this insensate and shortsighted emigration which can cause you nothing but expense?

"Do you not understand that by remaining here where you are well known by the people and the local trade, you have an ample field for rebuilding your deteriorated business and provide for your families and secure for them a bright future?

"Whatever may be the final fate which Providence reserves for this country, whether we remain Spanish or pass over to foreigners, our hard-working and honorable race will always remain deserving. There are instances in the Spanish-American Republics of fellow-countrymen of ours who are holding the most prominent places in those nations and who have been honored by their governments.

"If all that I have set forth is tangible truth, why should you abandon the field, why flee from this beautiful country where you have spent the years of your youth, raised families and acquired a good standing? If you consider my disinterested advice you cannot help but become convinced that, as matters now stand, your voluntary emigration is an absurdity.

"A PENINSULAR."

I have copied the letter literally, and it must be admitted that it is remarkable in every respect for diction, aspiration, and intention. I believe this example is quite sufficient, so I will refrain from citing others.

Those who to-day call and sign themselves Peninsulars, who have always called themselves Spaniards, what will they call themselves to-morrow?

XXXVIII.—GERONA AND SANTIAGO DE CUBA.

When sieges are spoken of in Spain, those of Numancia and Sagunto, Saragossa, and Gerona are always mentioned specially as instances worthy of imitation.

As twenty centuries have elapsed since the first two took place and I do not know what happened there, and am not sufficiently acquainted with the facts to venture on a comparison, I will leave them entirely out of the question; for since the customs and usages of warfare, as well as international law, and the rights of the people were, and could not help but be, very different from those of our days, there is nothing remarkable in the fact that as capitulations were not respected, people should have preferred to die like lions rather than be butchered like sheep.

Therefore I shall refer only to the siege of Gerona (no doubt quite as glorious as that of Saragossa) of which all Spaniards, myself included, are justly proud; and judging from General Linares's telegram, somebody had evidently had that siege in mind as a pattern or model to be followed here at Santiago de Cuba.

Everybody is acquainted with the circumstances of the siege of Gerona, but probably no one in the Peninsula with those of the siege of Santiago. All that I am going to say concerning it is pure truth, as can be testified by the 30,000 inhabitants of the city and the 40,000 Americans and 8,000 or 10,000 insurgents who laid siege to it.

It is true that Gerona in 1809 was far from being a Metz or a Sebastopol; but after all, it was a city surrounded by walls, with forts and redoubts on the outside communicating with the main precinct by open roads. For that reason the city could not be entered by surprise, but had to be regularly besieged, which made it necessary to construct parallel lines, set up batteries, cut off communications with the outside to prevent assistance from reaching the city, open a breach, or determine upon the assault, all of which costs time and lives.

Great was the anger caused in Spain by the invasion of Napoleon the First, and especially by the means which he employed to effect it. The Spanish believed their religion and independence threatened, and like one man they rose up in arms with an enthusiasm and energy not often paralleled in history.

Thus it was that the garrison of Gerona, which at the beginning of the siege consisted of about 6,000 men, enthusiastic as well as being Spanish, was not the only garrison that did the fighting. For all its inhabitants fought as well; the young and the strong with arms, the old and the weak by carrying cartridges and ammunition, the women by gathering up and caring for the sick and wounded, the clergy by absolving the dying, burying the dead, and stimulating the zeal of all. There everybody fought, everybody toiled, all were heroes, because it was their own property they were defending, their own hearths, their families, the soil where their forefathers were buried, their religion, their independence—in a word, their native country, and that is saying everything. They well earned their country's gratitude, from Mariano Alvarez de Castro to the last woman, the last child.

The troops which surrounded the city under Verdier and the Saint-Cyr troops protecting them and occupying the roads which lead to the city did not exceed in all 30,000, and although their artillery was more numerous and better manned, Gerona had artillery of the same caliber and the same range; that is to say—and this should be well borne in mind—that the Spanish projectiles carried as far as the French projectiles.

The firearms of that time are well known; the small arms were loaded in eleven movements, and I do not know how many it took to load the guns; the effect of the bombshell was moral rather than material, for it will be remembered that, in order to avoid them as much as possible, men were stationed in church steeples and other high places where they indicated the direction of such bombshells by prearranged signals. Besides it was easy to elude them in caves and cellars. If the powder gave out, the supply could always be renewed by burning a few doors and windows to obtain charcoal and mix it with a little saltpeter that could be found in any damp place, and a little sulphur. Any blacksmith could make cannon balls, and so on. Such were the firearms at the beginning of this century and their effects were accordingly.

Moreover, Gerona was aware that all Spain looked upon her with admiration and compassion; that each month, each week, each day that the resistance was prolonged and the French were kept outside the walls of the city, armies were being organized, regiments improvised, and armed bodies raised, and that there was but one idea and one desire in Catalonia, namely, that of helping Gerona, as, indeed, it had been helped once by getting in a convoy with provisions and over 3,000 men, and a second was ready. The city also knew that all assistance which it could get did really help to prolong the resistance, and the garrison was well aware that, if it should go out en masse and break through the hostile circle at any time, they would be safe and free, on their own soil, where they would have found all the resources and supplies they could wish for.

When they were not fighting, and did not have to be at the breach to repulse the columns of attack, or at the walls to force back an assault, they stationed their sentinels, guards, and patrols to keep watch, while the others could go where they were under shelter from the sun, the rain, and the dampness; in a word, they could take turns about in the service, and although they did not have much to eat, they could at least rest when the enemy permitted. Finally, Gerona preserved the remembrance and the pride of two former sieges which those same French forces had been obliged to give up, and there was well-founded hope of similar success if they received reënforcements, which was not at all improbable.

At the end of a six months' siege Gerona had to capitulate owing to starvation, but capitulate after all; and that capitulation, far from causing us to blush or be ashamed, is one of the most brilliant pages in our history, of which we are justly proud.

Those were the conditions of Gerona during that famous siege; now let us see the conditions of Santiago de Cuba.

Santiago de Cuba, as has been seen, is an open city, without forts, redoubts, or walls—in a word, without defenses of any kind. At the time the present conflict was declared the precinct of the city was surrounded by a wire inclosure which had been deemed sufficient, and indeed had proved so, to check the insurgents; but any one not acquainted with Santiago and the kind of warfare we had been sustaining, would have laughed at it, and with good reason.

Then the war with the United States broke out. I will not again mention the work effected for the protection of the precinct by the corps of engineers, without resources and appliances and with a scant personnel, which, though both enthusiastic and intelligent, had to confine itself to constructing trenches and protecting by earthworks the forts surrounding the precinct (if the name of forts can be given to a few blockhouses, but with a view to resisting musket fire, but surely not gun fire), erecting palisades and obstructions of every nature, for which purpose all the sinuosities and windings of the ground were utilized with remarkable skill. But all these works were only works of campaign, and left the soldiers exposed to the rays of the July sun of the Island of Cuba, to almost daily torrents of rain, and at night to heavy dew; any one acquainted with the island would know that, if these conditions had continued for a month, not a single soldier could have remained in the trenches.

Here at Santiago, as well as in the rest of the island, the soldiers, poorly clothed and still more poorly fed, had been sustaining for three years a fierce and thankless war, fighting with the enemy, the climate, with sun and dampness, with sickness, with the roads (or rather for want of them), with rains and drouth, with the mountains and plains—in a word, with everything, for here in Cuba everything is hostile to the army. Besides, there was more than eight months' pay due the soldiers, and I believe is still due them.

Before the destruction of our fleet, and still more so after it, the enemy had complete control of the sea, and from Daiquiri, where the landing was made, to Punta Cabrera, the American fleet, consisting of over seventy vessels, including both war and merchant vessels (many of the latter armed with guns), did not permit us to even think of receiving reënforcements or help of any kind, unless it were from the interior of the island.

After the arrival of General Escario, who might perhaps have checked the progress of the enemy for a little while longer if he had reached here prior to July 1, though he could not have changed the final result, provisions and ammunition, already scarce, became still more so, because there were twice the number of mouths to be fed and twice the number of muskets to be supplied.

Eight or nine thousand men, many suffering with fever and all of them tired and exhausted, who had been day and night in the trenches, which they could not leave for the simple reason that they were far from the city, with water reaching up to their waists whenever it rained, who for only food had rice bread and rice boiled in water, and for only artillery a few muzzle-loading guns, had to resist 40,000 Americans and 8,000 or 10,000 insurgents, with machine guns, also intrenched, and 68 breech-loading guns in advantageous positions and well manned.

The inhabitants, far from helping the soldiers or encouraging them, had left the city as soon as notice of an intended bombardment had been given, and the few who remained closed their doors and windows, even at the drug stores. The merchants, far from furnishing provisions to the army, or even to the hospitals, which stood so much in need of them, hid them carefully and official searches had to be made, the result of which was as I have stated above.

The situation of Santiago de Cuba from a military standpoint is probably unique in history.

Without any prospect of receiving help by sea, which was in control of a powerful fleet, the city was surrounded on land by an army five times as large as ours in numbers, with excellent artillery, which was increased every day and was constantly receiving provisions and war supplies.

Our forces, being without these latter, have no longer even the pleasure or comfort of fighting, for the enemy knows their situation better than they do themselves; knows that they have no food left but rice, and but very little ammunition, which they dare not use up for fear of becoming entirely disarmed and placing themselves completely at the mercy of the victor; knows that they can not expose themselves to another fight like that of July 1, which they remember with fear and terror; that they will be compelled to capitulate, and that it is only a question of days. Knowing all this, the hostile forces intrench themselves, train their artillery on the city, and also prepare to bombard it with their ships, which, from Aguadores, more than 4 miles from here, will soon reduce it to ashes and ruin, hurling upon it a hail of 16, 20, and 32 cm. shells, the effects of which will be seen only too well, even though we may not be able to see where the projectiles come from that are causing the ruin.

The enemy, as has been stated, had cut the aqueduct, thus depriving the city of water. There were a few wells and a number of cisterns, it is true, but the transportation of the water to the Socapa, Punta Gorda, and especially the blockhouses on the line from Las Cruces to Aguadores (4 kilometers), was not only extremely laborious and difficult, but quite inadequate.

But what makes this siege an exceptional one more than anything else is the fact that the reënforcements which could only have come by land would have had the opposite effect of what they were intended to have, as I will demonstrate.

Where could such reënforcements come from? From Holguin, Manzanillo, Guantánamo, or Havana. Holguin could have furnished five or six thousand men under Colonel Luque, but with only rations enough for the march, for there were no more at

Holguin, nor means for transporting them. From Manzanillo all those who could come had already arrived in command of General Escario. From Guantánamo none could come for lack of provisions. That left only those from Havana.

But I will go even further: I will suppose that all the reënforcements, including those from Havana under General Pando or any other general, had arrived, and that there had been forces enough at Santiago to rout the enemy, which is the most that could be conceded. What would have happened then? The enemy would have receded as far as the coast in less than an hour and their armorclads and other warships would have checked the progress of our army and would have made its victory and efforts useless, leaving it in worse condition than before the arrival of such reënforcements, since there would be many more men to feed; and everybody knows that the fields of Santiago have produced nothing during these last three years of warfare.

Some may say that there was one last recourse left: to force a passage through the hostile lines and march to Holguin. That is more easily said than done.

One cannot break through lines and walk over armies equipped with modern muskets and guns. Metz and Sedan have proved that, and it must be admitted that the French did fierce fighting at these places. We had to reconcentrate at a given point all our forces, scattered along an extensive line, and how could that be done without the enemy, whose lines were only a few meters from ours, seeing it all?

But I will concede even more: I will concede that it had been possible to accomplish the reconcentration; that the cavalry had been able to make a successful charge, which I do not believe would have been possible, for the horses were starving; I will grant, for the sake of argument, that the mules, which were in the same condition as the horses, had been able to transport the spare ammunition, provided there was any left, and the supplies of rice required for the march. Let us suppose that, after leaving two or three thousand dead and wounded on the field, the others had opened a road to Holguin; how could soldiers who were weak and sick accomplish the forced march which would have been absolutely necessary in order to escape the enemy's pursuit? It was an impossibility. The insurgents would have harassed us on the march, fighting for every inch of the ground, and would have wounded a more or less considerable number of our men, thereby delaying a march which it was so imperative to hasten, and the Americans, who would no doubt have followed our tracks, would thereby have gained time to overtake us with overwhelming numbers, and we should have been compelled to surrender to them at their pleasure for want of ammunition, or to perish to the last man, and such a sacrifice would have profited Spain no more than had the sacrifice of the fleet, and would have deprived the nation of 8000 soldiers who by three years of fighting had become inured to war.

If the hostile fleet had bombarded the city, as it doubtless would have done, it would have reduced it to ruins and ashes in a short space of time, and while, from a military standpoint, such a consideration should not influence a general and impel him to capitulate on that account alone, in this case the ruin of the city meant also that of its defenders; for if it was difficult to supply enough water in normal times it would have become altogether impossible under such circumstances; the soldiers, exposed to the sun all day, would have been without anything to drink, which is worse even than being without anything to eat.

Finally, what and whom were we defending in Santiago? The Cubans, after three years of fighting, preferred to become Yankees rather than remain Spaniards, and the Peninsulars, far from assisting the soldiers who were defending them, took advantage of the situation to raise in the most outrageous manner the price of all articles, even those of first necessity, or hide them, giving the impression that they had been confiscated, and when the time of danger arrived they left the city, taking off the uniform of volunteers, in which they had always taken good care to shine at reviews and in processions, and went to hide at El Caney, in merchant steamers, and at Cinco Reales.

Such were the situation and circumstances which, at Santiago, led to the signing of the capitulation, by virtue of which we Spaniards, who happen to be here, are to return to Spain.

I do not wish to make comparisons, nor express my opinion on events in which I have taken a more or less direct and active part, as such opinion might appear impassioned or dictated by interest or egotism. I have stated what happened at Gerona and what happened here, like Bertrand du Guesclin, without omitting or adding anything. Now, let the country, knowing the circumstances, judge us. With a calm mind and a clear conscience I await its sentence.

PROFESSIONAL NOTES.

TESTS OF ARMOR-PLATES FOR THE JAPANESE BATTLE-SHIP ASAHI.

Messrs. John Brown and Co., Limited, of Sheffield, who are making the armor for the Imperial Japanese battle-ship Asahi, now building on the Clyde by the Clydebank Engineering and Shipbuilding Company, Limited, submitted for firing test on December 2nd last a piece cut from one of that ship's partly finished belt plates, which had been selected for the purpose by the Japanese authorities, and the admirable results got are stated.

Doubts have sometimes been cast upon the severity of armor plate trials made in England, on the ground that Holtzer shot are usually employed; that Holtzer's process of manufacture is an old one; and that the Americans in particular have so improved upon it that shot made by their processes are far more formidable, and so confer more credit on the plate that succeeds in defeating them. It is therefore highly satisfactory to have these doubts proved groundless by the behavior of the plate whose trial we are reporting, which achieved the very marked success shown after the attack of three projectiles made on the most highly vaunted American process—that known as "Wheeler-Sterling." The following are the particulars of the plate:

Dimensions of plate	8 ft. by 8 ft. by 8.8 in.
Weight	10.175 tons.
Nature of backing	12 in. of oak, and a skin plate 1¼ in. thick.
Number of blows	three.
Projectiles	8-in. armor-piercing steel of 250 lb. weight, made by Messrs. Sir W. G. Armstrong, Whitworth and Co., Limited, on the "Wheeler-Sterling" process.

	1st Round.	2d Round.	3d Round.
Striking velocities, foot-seconds	1859	1964	2039
Striking energies, foot-tons	5991	6687	7208
Calculated thickness of wrought iron perforable, inches	17	18½	19½
Proportional thickness of wrought iron perforable, taking thickness of test-plate as unity	1.93	2.10	2.22

All the projectiles were completely shattered, and that the injury sustained by the plate was confined to the usual splintering of its face round the points of impact, and a few superficial hair cracks in the face so fine as to be almost invisible. No cracks whatever beyond these could be found in any part, and the attack left no mark on the back except the three smooth bulges, of which the most prominent measured 1½ in. in height. The Japanese Government was represented at the trial by Admiral Matsunaga, Captain Mukoyama (Naval Attaché), and Constructor Captain Kondo, and the highest approval was expressed of the excellence of the result.—*Engineering.*

THE IDEAL SMOKELESS POWDER.

Great as are the advantages of the best forms of nitroglycerine and guncotton smokeless powder, there is not one of them that can be called an ideal powder. They all suffer from an inherent and ineradicable defect, due to the presence of the nitroglycerine and the fact that its explosive qualities are affected by changes of temperature. The best of these powders might be considered ideal explosives, provided they were always used at exactly the right temperature; but they never or rarely ever are.

When it is stated that 19.5 pounds of cordite fired behind a 100-pound projectile in a 50-caliber 6-inch gun will produce a muzzle velocity of 2642 feet a second, the statement is not altogether complete; since one of the elements effecting these results has been omitted—or rather, it is supposed to be understood. Strictly speaking, these results can only be obtained if the powder at the moment of firing is at the normal temperature of the atmosphere. If its temperature is lower, as it would be in the Arctic regions, the velocity will be lower, and if it should be higher, as during an engagement in the tropics, the velocity will be higher. Now between these extremes of cold and heat there will be a difference of velocity which will interfere with the accuracy of the gun; for the sights are adjusted for the velocities due to the powder when fired at normal temperatures.

The pressures, moreover, are even more liable to change than the velocities. It frequently happens that a gun becomes quite hot from firing or from being exposed to the rays of the sun. While in this heated condition a charge may be inserted and, for some reason, allowed to remain for some length of time in the chamber before being fired. The heat of the gun is imparted to the powder, and in this heated condition it is liable to produce abnormally high pressures, and may even detonate and destroy the weapon. It is a fact that in some makes of machine guns serious accidents have resulted from leaving the piece loaded for a few minutes when the gun was overheated.

These troubles are entirely due to the nitroglycerine, and they are inseparable from any powders that include this powerful agent as one of the constituents.

For these reasons several of the European nations have always opposed the use of nitroglycerine in any form, and a vast amount of experimental work has been done in the hope of producing a smokeless powder that should contain none of this explosive. We are reliably informed that a certain Austrian chemist, who is considered to be the greatest European expert on high explosives, has at last produced a smokeless powder which is entirely free from the defects alluded to and is as safe and reliable as the old black powder. It contains no nitroglycerine and it is affected very little by overheating. It is not only very effective, but it can be manufactured much more cheaply than smokeless powder of the ordinary type.

Our informant, who is perhaps the most noted expert in rapid-fire weapons in Europe, states that the discovery has produced a sensation in naval and military circles, and that great expectations are entertained regarding the new explosive, regarding which particulars will be made public early in the year.—*Scientific American.*

VICKERS' 12-IN. GUN.

We describe the new breech mechanism of the 12-in. breechloading gun designed and manufactured by Messrs. Vickers, Sons, and Maxim, Limited, and now adopted also as the standard weapon by the Woolwich authorities. We have in previous volumes fully described the gun and its manufacture, and it is only necessary here to deal with the new mechanism which may be fitted to the 12-in., 10-in., and 9.2-in. gun, and may be fitted with the necessary gear to enable it to be worked by hydraulic or other power; it is applicable to any gun of smaller or larger calibre, and is suitable for either right or left-hand guns. The mechanism is so arranged that by turning the handwheel the breech plug is first rotated and unlocked, and then swung out of the breech of the gun. The unlocking of the breech plug is effected by means of what is commonly known as a toggle joint, the longer arm or link of which has one end fitted on a pin on the face of the breech plug, and the other end is fitted by a pivot joint to the shorter arm or crank mounted in a recess in the carrier on a pivot parallel with the axis of the gun, both the link and the crank thus working in a plane parallel to the face of the breech. Round the boss of the crank are formed "skew gear" teeth, engaging into similar teeth formed partly round the boss of an intermediate quadrant pinion, which is also mounted in the carrier, but on a vertical pivot. This intermediate quadrant pinion has also formed partly round the boss ordinary spur teeth, which engage with similar teeth on an actuating quadrant pinion fixed on the hinge bolt of the carrier. The hinge bolt, together with the actuating pinion, are revolved by means of a worm and a wormwheel, which are in turn actuated by a handwheel suitably mounted at the breech of the gun.

To open the breech the handwheel is rotated, and thus by means of the wormwheel, the actuating pinion causes the intermediate quadrant and crank to turn, thus rotating the breech plug until it becomes unlocked. By continued turning of the handwheel, the carrier with the breech plug is swung out clear of the breech of the gun. The ordinary retaining catch is employed for holding the plug in position when out of the gun. The opposite action takes place on closing the breech. The gun is arranged for firing by electric or percussion tubes, and its action is similar to that of the 6-in. quick-firing gun. A cam in the crank, acting upon the firing gear slide during the first turning of the handwheel, when unlocking the breech, makes the gun absolutely safe before the breech-plug commences to unscrew, and by the continued movement of the crank-cam, the empty tube or primer is automatically ejected.—*Engineering.*

MASONRY VERSUS WOODEN DRY DOCKS.

There is a growing conviction among naval men that the United States should cease to build wooden dry docks and in future construct all of its docks of masonry. The principal argument in favor of wooden structures is, or used to be, the smaller first cost. While a timber dock could be built for from $400,000 to $600,000 according to its size, a similar masonry structure used to cost from two to three million dollars. This of course was an extravagant figure, but seems to have been unavoidable under the plan of periodical appropriations by Congress, which caused the work to extend over long periods with much consequent waste of time and money.

The recent bidding for a stone dry dock at Boston brought out the welcome fact that a masonry structure can be built for a moderate increase of cost over one of timber. The cost of the dock will be about $1,000,000 whereas the timber dry dock (known as No. 3) at the Brooklyn navy yard cost between $600,000 and $700,000, and in the two years of its existence it has cost for repairs $171,000.

Prof. W. L. Cathcart, of Columbia University, in a paper on the subject read before the American Society of Civil Engineers, gives some significant figures regarding the cost of repairs on the two types of docks, in which it is shown that the least average annual expenditure for repairs and maintenance was $230 per year for the stone dock at Mare Island, while the highest expenditure was that upon the Brooklyn navy yard wooden dock, above mentioned, which averaged $85,500 per year. A comparison of three stone docks, those at Boston, Norfolk, and Mare Island, shows an average yearly expenditure of $1558, while the average on four timber docks at New York, League Island, Norfolk, and Port Royal, was $13,364. Commodore Endicott, Chief of the Bureau of Yards and Docks, stated that a timber dock has to be practically rebuilt in from twenty to twenty-five years, the experience of the navy all tending to prove that the masonry dock is superior in practically every respect.—*Scientific American.*

COAST TELEGRAPHIC COMMUNICATION.

By Charles Bright, F. R. S. E., A. M. Inst. C. E.

(History.)

Although electrical communication with lighthouses and light vessels has been a subject of discussion for a number of years, but little has been actually done in that direction. We have, in fact, scarcely emerged from the experimental stage in this class of work.

Let us pass in review the state of affairs as regards operations of this character so far carried out. In 1870 an essay was made to establish a floating telegraph station off the Land's End. The Telegraph Construction Company was the promoter of this enterprise, besides carrying it through in every particular. In the first instance Capt. Burrows was the principal moving spirit in the scheme.

The Brisk, an old corvette, was fitted up with a telegraph cable, towed out to a position some fifty miles from the shore, and anchored in sixty fathoms of water, using a four-ton Martin's anchor, and 400 fathoms of chain. The telegraph cable, we are told, was taken to the masthead, and when the vessel rolled the cable beat so heavily against the ship's side that it was injured considerably. When the ship swung to the tide the cable had to be lifted over the vessel, the consequence was that it frequently fouled the chain and was broken.

This experiment was maintained from April 14th to June 16th, 1870. No dependence could be placed in the communication, as the cable was never in a satisfactory condition for more than a few days together. Some £15,000 was expended over this experiment. The experience gained led to the introduction and adoption of Bedwell's hollow-swivel device—patent No. 367 of 1876—in subsequent trials. By this plan the telegraph cable is drawn through the center of a mooring swivel having a hollow spindle. From this revolving swivel one or more chains lead to the moorings in a downward direction; in an upward direction a chain, or chains, lead to the inside of the vessel in the ordinary manner. The end of the electric cable below the vessel is passed up through the hollow swivel, over a sheave to inboard the vessel in such a way as ensures it always being a certain distance from the mooring chain. It so avoids chafing with it. To prevent the cable from being injured by the swinging of the vessel with the tide, which occurs four times each day, a sufficient quantity of cable is wound on a revolving drum placed in a revolving frame. The whole, or any part of the, apparatus may be kept in a tank containing water. The chain which is wound on the drum may be paid out in the event of it being necessary to veer the ship's chain cable.

From 1870 to 1884 nothing further was attempted in the direction of lightship telegraphic communication. In the early part of the latter year a telegraph cable was established by the Telegraph Construction Company between the Sunk lightship and Walton-on-the-Naze. The vessel was of 189 tons; builders' measurements, 90 ft. long by 21 ft. 6 in. broad, and 10 ft. deep. This ship proved to be too small for the purpose; she shipped much water in heavy weather, and was severely strained at the bows through the extra weight of a heavy swivel and the tension of taut chain bridles. Moreover, in heavy gales, spray would at times entirely eclipse the light, owing to the ship being pinned down by her moorings and pitching heavily. The moorings consisted of two lengths of 1½-in. chain lying east and west, forming two arms, with a Bedwell swivel at the junction. The anchors were of two and three tons respectively, of the mushroom type. The depth at high water was ten fathoms.

It was originally intended to thread the telegraph cable through a double-chain cable of special construction as designed by Mr. F. R. Lucas—patent No. 3463, of 1881. One of the main features in this patent was the ingenious swivel or revolving joint for the cable there suggested. This revolving joint was of such construction as always to permit of the cable revolving freely in either direction, and so allowing its turns to run out, besides providing for the movement of such parts—within certain limits—in any direction, at all times preserving the electrical continuity and insulation of the conductor. Thus, by means of this novel arrangement, the telegraph cable could be relieved of the turns or twists occasioned by the ship swinging to the tide, without in any way interfering with its electrical duties. It was found, however, that this cable presented great difficulties in manufacture.

Moreover, it was thought that the incessant hammering involved would tend to affect injuriously the electric cable within; and it is certainly quite possible that the vibration here entailed might be the cause of disintegration in the conductor, or dielectric, at the joints. Subsequently a steel wire mooring cable was adopted, with the ordinary electric cable—

of light type—inside. This did not prove a success, three or four breaks occurring between December, 1884, and March, 1885. In March, 1885, the steel mooring cable was replaced by ordinary chain, and a light type telegraph cable used for connecting up on board and veering with. This cable was passed through the hollow spindle of the swivel already described, and 200 fathoms of it kept wound on a revolving drum. In this connection it may be mentioned that the late Captain Robert Halpin, R. N. R., has pointed out that it is only within 50 or 60 fathoms of a lightship that any damage occurs to the telegraph cable.

It would be altogether exceeding our scope to go further into the details of this early experiment of telegraphic communication with the Sunk lightship. Suffice it to say that the contractors and every one concerned did their utmost to make it a success. The result, however, could hardly be looked upon with favor, there being as many as ninety days of interruption during two years. The experiment was begun in December, 1884, and after maintaining it at heavy cost for a year, was handed over by the contractors to the Trinity Board in March, 1886. The pioneer work done by the Telegraph Construction and Maintenance Company in this matter must never be forgotten. It has, moreover, been most useful in a general way as the only data to work upon in similar undertakings.

The communication between the Sunk and the shore was both telegraphic and telephonic, the telephone being preferred; indeed, this popular instrument proved by far the most useful, and could be used when both the "Morse" and Wheatstone's A. B. C. were unworkable. Next in usefulness to the telephone was the A. B. C., the "Morse" recorder being practically never used in ordinary work. The length of the cable was nine nautical miles, and the distance over ground was 8.8 nautical miles.

There were four extra men employed on board the Sunk, but it does not follow from this that any extra hands would be required as a rule, for it was only necessary in this experiment on account of the antiquated form of windlass, and the frequent kinking of the cable, involving periodic repairs. All the men employed were regular lightship hands. Those singled out for telegraphic duties and cable repairs showed great aptitude in acquiring the details of the work, as regards jointing, splicing, and using the instruments. Though going a long way to meeting the difficulties to be contended with, the plan of passing the telegraph cable up over the bows of the lightship through a hollow revolving swivel was not found to be as perfect as was expected previous to the Sunk experiment. Means may yet be discovered by which the difficulties then experienced will be overcome. Meanwhile it may be remarked that the very reason why telegraphic communication with a lightship is required at all is due to the somewhat frequent occurrence of wrecks in the immediate vicinity, the lightship itself being very often placed on a reef of some sort. If, moreover, a strong current prevails, as is not uncommonly the case, the cable is liable to get shifted, and twisted up with the lightship moorings.

It has been suggested by Mr. H. Benest, A. M. Inst. C. E., that the cable might suitably stop short of the lightship, by its end being taken up to a buoy within such a distance of the vessel as would be outside her range of swing. According to this plan the buoy would be constructed with a central hawse for the telegraph cable to pass through. There

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ARMY OF OPERATIONS

DIVISION OF CUBA

SANTIAGO BRIGADE

SKETCH OF SANTIAGO DE CUBA AND VICINITY

Prepared in the Office of Naval Intelligence
NAVY DEPARTMENT
NOV 1898

From a map accompanying
"COMBATES Y CAPITULACION DE SANTIAGO DE CUBA"

West Boundary = Nina Nina river, Alto Hermitano, Alturas Santa Gertrudis and Santa Rosa al Cobre.
North Boundary = Puerto Bayamo road, Sierra Maestra through the passes of Corralillo, Ysleno, Enramadas and Boniato al Cristo.
East Boundary = Sierra Maestra, Heights of Escandell and Villalon in S.E. direction towards Gran Piedra, Heights of Folie and Mogote ending S. with the boundary line of the rivers Daiquiri and Berraco.

Scale $\frac{1}{50.000}$ 0 500 1000 = 1 Km.

Explanations.

- Buildings.
- Water courses and ravines.
- Wagon road.
- Foot "
- Path.
- Pier.
- Fort.
- House entrenched, occupied by forces.
- Small guard house occupied by detachments of the Civil Guard.
- Foot paths in mineral Regions
- Barb or plain wire.
- Telegraph station.
- Signal teleg. aph or heliograph station
- Telephone "
- 6 ft barb wire, surrounding the City of Santiago.
- Trenches.

Forts and detached points in the district of Santiago.

1 F.t Maboa — Cobre
2 " Fortin — Cobre
3 " Santuario — Cobre
4 " Loma Cruz
5 " Puerto Bayamo
6 " " Corralillo — In the Sierra Maestra
7 " " Ysleno — In the Sierra Maestra
8 " " Enramadas — In the Sierra Maestra
9 " " Boniato — In the Sierra Maestra
10 " " Dajao
11 " Puente Purgatorio.
12 House — Cuabitas
13 F.t N.o 1 — Cuabitas
14 " N.o 2 — Cuabitas
15 Station — Cuabitas
16 F.t alto Represa — On the R.R from Santiago to Cristo.
17 " bajo " — On the R.R from Santiago to Cristo.
18 " Boniato — On the R.R from Santiago to Cristo.
19 " P.te Boniato — On the R.R from Santiago to Cristo.
20 " S.n Vicente — On the R.R from Santiago to Cristo.
21 " Dos Bocas — On the R.R from Santiago to Cristo.
22 " Cutie ó Barges — Cristo
23 " Cuba ó España — Cristo
24 " Colon ú Ochando — Cristo
25 " Manacas ó S. Luciora — Cristo
26 " Gasco ó Voluntarios — Cristo
27 " Casa Azul — Cristo
28 " Factoria ó Ahumada — Cristo
29 " V.m Alegre ó Weyler — Cristo
30 " Vista Hermosa — Cristo
31 " Guaninicumo ó Garcia — Cristo
32 Paraiso ó Franco — Cristo
33 F.t N.o 1 Station — Cristo
34 " N.o 2 "
35 " P.te Manacas
36 " P.te Guaninicum
37 " N.o 1 Escandell
38 " N.o 2
39 " Viso

40 F.t Rio — Caney.
41 " Cementerio — Caney.
42 " Yzquierdo — Caney.
43 " Matadero — Caney.
44 " Asta — Caney.
45 " Pozo
46 " San Juan
47 " S. Miguel de Parada
48 " S. Jose "
49 " Buena Vista — On the Bay of Santiago.
50 " Cayo Duan — On the Bay of Santiago.
51 " Rente — On the Bay of Santiago.
52 " Cayo Ratones — On the Bay of Santiago.
53 " Cayo Smith — On the Bay of Santiago.
54 " Socapa — On the Bay of Santiago.
55 " Morro — "
56 Estrella Battery — "
57 F.t Cruces
58 Punta Blanca — In the outer precinct of Santiago city
59 F.t Gasometro — In the outer precinct of Santiago city
60 Furnaces — In the outer precinct of Santiago city
61 F.t Nuevo — In the outer precinct of the City of Santiago.
62 " Beneficencia — In the outer precinct of the City of Santiago.
63 " Canadas — In the outer precinct of the City of Santiago.
64 " S.ta Ursula — In the outer precinct of the City of Santiago.
65 " Guayabito — In the outer precinct of the City of Santiago.
66 " Canosa — In the outer precinct of the City of Santiago.
67 " Santa Ines — In the outer precinct of the City of Santiago.
68 " Cuabitas — In the outer precinct of the City of Santiago.
69 " S.t Antonio — In the outer precinct of the City of Santiago.
70 " Yarayo — In the outer precinct of the City of Santiago.
71 " Barges — In the outer precinct of the City of Santiago.
72 " Dos Caminos del Cobre — "
73 " N.o 1 Inflamable stores. — "
74 " N.o 2 " " — "
75 " Aguadores — On the S. coast and on the R. of the Juragua Mines
76 " Sardinero — On the S. coast and on the R. of the Juragua Mines
77 " Julcei. — On the S. coast and on the R. of the Juragua Mines

78 F.t Rabenet — Siboney
79 " Infante — Siboney
80 " Duran — Siboney
81 " Vazquez ó Suberbiola — West part of the Juragua Mines
82 " Anacahuita — West part of the Juragua Mines
83 " Moya ó Aguado Soto — West part of the Juragua Mines
84 " Clinica ó Marin Beltran — Camp of Firmeza.
85 " Abat — Firmeza
86 " Fern.z Martin — Firmeza
87 " Guerrero — Firmeza
88 " Zubia — Firmeza
89 " Maky — Firmeza
90 " Macias — Firmeza
91 " Puig — Firmeza
92 " Delgado — Firmeza
93 " Alegre — Firmeza
94 " Ibanez — On the Folie Hill.
95 " Diaz Flor — On the Concordia Hill.
96 " Mercote — On the Concordia Hill.
97 " Salamanca — On the Concordia Hill.
98 " Garcia — On the Concordia Hill.
99 " Valdivia — On the Concordia Hill.
100 " Santana — On the Concordia Hill.
101 " Barges — On the Prudencia Hill.
102 " Chalons — On the Prudencia Hill.
103 " Duque — Vinent.
104 " Castellano — Vinent.
105 " Toledo — Vinent.
106 " Represa — Vinent.
107 " Latorre — Vinent.
108 " Palacios — Vinent.
109 " Aguero — Vinent.
110 " Canade — Vinent.
111 " Montaner — Vinent.
112 " Vega — On the Coast Road.
113 " Pamier — Daiquiri.
114 " Izquierdo. — Daiquiri.
115 " Chirivechos. — Daiquiri.
116 " Lanzagorta — Daiquiri.
117 " Alvarez Espejo — Daiquiri.

RAMON (RHK)

would also be other hawse pipes for its moorings, which should be carefully carried out in different directions, and at some distance from the electric cable. The conductor of the cable would, in this device, be led into a water-tight box on the upper part of the framework of the buoy. to make connection with a lighter type of veering cable, which should extend from the lightship to the buoy. On board the lightship some length of the veering cable could be kept on a drum, which drum could be mounted on a traveller, free to run right round the ship on the bulwark rail. The signalling instrument would require to be disconnected when necessary to run the drum from one side of the ship to the other when swinging. In order to keep the cable in its normal state as regards lay, the drum should be pivoted. Respecting the class of buoy for this purpose, the Trinity House have of late years adopted one which might prove suitable. It is of peculiar shape, having a cylindrical belt round its circumference near to the base, which has the effect of producing great steadiness. Within recent times, experiments have been made with some success in the direction of communicating telegraphically through ordinary iron chain. By this plan ordinary electric cable might terminate at the mooring of a light vessel and her own chain be left to complete the circuit. The chain cable being practically a bare conductor, the external presence of rust—or paint—would be a distinct advantage, inasmuch as it would play the part of an insulator. An ingenious form of electrical swivel has been devised by Mr. James Wimshurst, F. R. S., for avoiding the kinks in cables attached to moored lightships swinging with the tide. It was exhibited at the annual conversazione of the Royal Society in 1894, and might be useful in this connection. Mr. Wimshurst's device does not, however, in any way meet one serious source of trouble—that of constant wear and tear on the bottom, due to rise and fall.

For further and full particulars regarding the work already done—and which it is proposed should be done—in this direction, the reader is referred to the Blue-book of the Royal Commission on Lighthouses and Light Vessels. This Commission commenced sitting in 1892, and has only lately completed its periodic deliberations. In the result, it has issued five reports, respectively in 1893, 1894, 1895, 1896 and 1897. The Commission paid a visit to Denmark in 1896 to inspect the very complete telegraphic arrangements with light vessels and lighthouses on that coast, subsequent to which they drew their final report on this all-important question. The reader's attention may also be called to a paper on "Coast Telegraph Communication," read before the Balloon Society in 1892, by Mr. Benest.—*The Engineer.*

THE PROPOSED ADDITIONS TO THE ACTIVE LIST.

The proposal of the Minister of Marine to increase the list of officers of the navy by 1 vice-admiral, 5 capitaines de vaisseau, 25 capitaines de frégate, 75 lieutenants, and 80 engineers, has been approved by the Commission de la Marine of the Chamber, except as regards the vice-admiral, which is not thought necessary, as by the present list when all appointments are filled there will still be 2 vice-admirals for disposal. This increase to the number of officers being contemporaneous with a similar increase in the English navy has given occasion for a comparison of the prospects of advancement in the two Services, which the *Temps* gives as follows:—In the English navy the percentage of admirals to all junior grades up to and including that of lieutenant is 3.7 per cent., and to the superior grades of captain and commander 13 per cent. The percentage of superior grades (namely, captain and commander) to the lieutenants being 39 per cent. In the French navy, by the new increase, the above proportions are respectively 3.83 per cent., 12.3 per cent., and 44.63 per cent., from which it appears that though the chances of superior officers obtaining flag rank are slightly less favorable in the French than in the English navy, on the other hand the French naval lieutenant has a better chance of rising to the rank of captain or commander than his English *confrère.—Journal Royal United Service.*

SHIPS OF WAR.

[ENGLAND.]

H. M. S. POMONE.

When recording the trials of her Majesty's third-class cruiser Pactolus in our issue of October 28th, 1898, we incidentally mentioned that a sister ship, then building, would be engined by the same firm, Messrs. John Penn and Sons, of Greenwich. This vessel, the Pomone—a full page illustration of which we gave in a previous issue, November 26th, 1897—has now been so far completed as to have been able to undergo her speed and other trials, which have taken place during the past fortnight.

As the Pomone is in every respect a duplicate of the Pactolus, both as to dimensions, displacement, type of engines, boilers, etc., we do not repeat the particulars, as they will be found fully given in the issue of October above mentioned. Some valuable experience having been acquired during the trials of the Pactolus, especially in connection with her boilers—they being of a comparatively new type, the Blechynden water-tube—great care has been given to the boiler installation of the Pomone, so as to ensure satisfactory results, free from delay, when under trial.

The contract requirements of the vessel's trials were exactly. the same as those of the Pactolus, viz. the development of 3500, 5000, and 7000 indicated horse-power by her engines, in the coal consumption, natural and forced draught trials respectively; and from the results attained at them, which we give below, it will be seen that these requirements were in each case largely exceeded.

Having been built in Sheerness Dockyard, and of only a moderate water draught, her trials took place in the North Sea. A previous preliminary run having been made to see that all was in order, on February 16th the vessel left Sheerness and proceeded to sea for a thirty-hours' coal consumption trial at 3500 horse-power, her water draught at the time being 12 ft. forward and 15 ft. aft; the weather being fairly good. This trial was continued without intermission or stoppage until completed; the mean results attained at it being that a steam pressure of 242 lbs. per square inch was easily maintained in the boilers with an air pressure in the stokeholds of .88 in. of water; the engines making 173.7 and 172.6 revolutions a minute for starboard and port, and developing respectively

1798 and 1811 indicated horse-power, or a total of 3609; the vacuum being a mean of 25 in., and the speed of ship 16½ knots an hour, coal having been consumed at the rate of 2.45 lbs. per indicated horse-power per hour. This trial, during which the engines and boilers worked in a highly satisfactory manner and gave no trouble, was completed on Friday, February 17th, when the ship returned to Sheerness.

On Tuesday, February 21st, the weather being rough, the ship proceeded on a natural-draught trial of eight hours' duration, on which she attained the following satisfactory mean results: With the vessel drawing the same water as before, and steam maintained at 220 lbs. pressure per square inch in the boilers, with an air pressure of 1.4 in. of water in the stokeholds, and the starboard and port engines making 198.3 and 203.6 revolutions per minute respectively, there was developed by them a gross total of 5617 indicated horse-power, giving the ship a speed of 20 knots an hour.

Having cleaned boiler tubes, and seen that all engine and boiler connections, etc., were in order, the Pomone proceeded to sea on Saturday last for a four-hours' full-power—7000 indicated horse-power—forced-draught trial, the weather being very fine, and the sea fairly smooth. The results of this trial, which were highly satisfactory, were: With the ship having a slightly deeper water draught than on the previous trials, and a steam pressure in her boilers of practically 252 lbs. per square inch, maintained with an air pressure of 2.777 in. of water, the revolutions of the starboard and port engines were 219.6 and 221 per minute respectively, and the gross total power developed by them 7340 indicated horses, giving the ship a speed of 21.5 knots an hour.

From the foregoing recorded results of the Pomone's trials, it will be seen that the contract power requirements were exceeded at each, and that the engineers have beaten their own power record made in the case of the Pactolus, which was the highest then attained in the class of vessel. The trials of the Pomone have also been noteworthy, in that they have been continuous and without a break, and taking the time actually occupied in accomplishing them, have been completed within a week. The officials present at them were: Mr. F. H. Lister, representing the Admiralty; Mr. R. H. Andrews, chief engineer of Sheerness Dockyard; Mr. E. Thomas, of the Sheerness Fleet Reserve; and Mr. W. B. Dixon, representing the contracting engineers, Messrs. Jno. Penn and Sons. The vessel was in charge of Commander G. C. A. Marescaux, of the Sheerness Fleet Reserve.—*The Engineer*.

H. M. S. Ariadne.

H. M. S. Ariadne, a first-class protective deck cruiser, of the improved Diadem class, built and engined by the Clydebank Engineering and Shipbuilding Company, Limited, on the Clyde, completed on Tuesday, the 7th inst., a series of contract steam trials, and the detailed results are given on the next page. The Ariadne, so far as the hull is concerned, in which we include offensive and defensive qualities, resembles closely the Diadem class, which has been fully described in *Engineering*, the preceding vessel of the class built at Clydebank, being the Europa. The only difference is in the boilers. The boilers of the later ships have been designed with slightly more heating surface than the Europa, 47,300 square feet of heating surface and 1390 square feet of grate area, the ratio being 34.0 to 1; while in the case of the Europa, with the same number of boilers, the ratio is 27.73 to 1, the heating surface being

40,600 square feet, and the grate area 1450 square feet. The Ariadne, of course, represents the later practice, and as the horse-power to be developed is 1500 more than with the Europa, it will be seen that the coal burned per square foot of grate per hour is higher. On the full-power trial it was nearly 22 lbs. per square foot of grate, as against 21 lbs. in the Diadem class. The power per square foot of grate was 13.2 indicated horse-power, as against 11.63 indicated horse-power in the Europa; but in special trials both these results have been exceeded. The heating surface is equal to 2.48 square feet per unit of power maintained; in the Europa it was 2.38. If the table now given be compared with the corresponding one published by us in July last, giving the Europa's results, it will also be seen that the coal consumption is much less. In each type of ship there are 30 Belleville boilers with economizers. The engines are of the triple-expansion type, but the arrangement in the Ariadne differs from that in the Europa. Instead of the four cylinders being placed as follows from the bow end: High-pressure, intermediate pressure, and the two low-pressures with the valves between each, the order is as follows: Low-pressure slide valve, low-pressure cylinder, high-pressure cylinder, high-pressure piston valve; intermediate pressure piston valve, intermediate pressure cylinder, low-pressure cylinder, and low-pressure piston valve. Thus the cylinders are in pairs as closely together as is possible, and the sequence of cranks is—high-pressure, intermediate pressure, forward low-pressure, after low-pressure, the first and third named being at right angles, as are the other two. This arrangement gave practically no vibration. The diameters of cylinders are 34 in., 55½ in., 64 in., and 64 in. by 48 in. stroke. They were designed to give the full power at 120 revolutions, while in the case of the Europa the designed speed was 110 revolutions, although with 112.4 revolutions 17,010 indicated horse-power was got, while the Ariadne got 19,156 indicated horse-power with 118.9 revolutions.

RESULTS OF STEAM TRIALS OF H.M.S. ARIADNE (11,000 TONS AND 18,000 INDICATED HORSE-POWER).

BUILT AND ENGINED BY THE CLYDEBANK ENGINEERING AND SHIPBUILDING COMPANY, LIMITED.

Description of trial		30 bours' coal consumption at 3600 I. H.P.		30 hours' coal consumption at 3,500 I.H.P.		8 hours' full power	
When tried		January 31 and February 1, 1899		February 3 and 4, 1699		February 6, 1899	
Draught of water	Forward	25 ft. 5 in.		24 ft. 8½ in.		24 ft. 3 in.	
	Aft	26 " 2 "		25 " 11½ "		26 " 3 "	
Displacement		......		......		......	
Actual load on safety valves ... lbs.		300		300		300	
Pressure of air in stokehold .. in. of water		......		......		.23	
Average pressure at boilers		218		262		288	
" " at engines		202		227		240	
Receiver pressures	H. P.	143.5		206.5		229	
	I. P.	34.5		58.5		75.5	
	L. P.	5		18		24.5	
Average vacuum		24.8		25.5		25.3	
Mean pressure in cylinders	H. P.	20.6	17.7	84.2	87.5	103.4	104.7
	I. P.	17.3	18.1	32.9	33.1	40.3	41.9
	L. P. forward	7.8	6.3	16.3	16.7	21.3	21.1
	L. P. aft	7.6	7.3	17.4	16.4	22.6	20.9
Mean number of revolutions per minute		70.3		109.1		118.9	
Indicated horse-power ... total		3,758		14,046		19,156	
Speed ... knots		13.3		20.1		21.5	
Force of wind		2 to 3		1 to 6		2 to 8	
State of sea		Slight swell		Smooth to moderate		Moderate swell	
Propeller	Diameter	17 ft.		......		......	
	Pitch	21 ft. 6 in.		Same		Same	
Consumption per indicated horse-power per hour		2.05		1.73		1.66	

The Ariadne, it may be said, is 435 ft. long between perpendiculars, 69 ft. beam, and at 24 ft. 7 in. draught displaces 11,070 tons. As will be seen from the table, the vessel had water ballast in her to insure that the draught would be even greater than that stipulated for, and yet on all occasions she succeeded easily in attaining her speed over the measured distance course between the Dodman and Rame Head, the top mean speed for 19,156 indicated horse-power being 21.5 knots, against the 20.75 knots for 18,000 indicated horse-power anticipated in the design. The vessel left Chatham Dockyard on Monday, the 30th ult., and after proceeding to Sheerness for adjustment of compasses and having a preliminary run, she commenced her 30-hours' trial of one-fifth the total power on Tuesday afternoon, the 31st, and anchored in Plymouth Sound on the following night about 10 o'clock. The results of this trial proved to be satisfactory, the mean indicated horse-power being 3758, with 70.3 revolutions; while the draught of the ship was 25 ft. 5 in. forward and 26 ft. 2 in. aft, the speed being 13.3 knots. The following day at noon she went to sea for her deep-water anchor and cable trials, at the conclusion of which the 30-hours' trial at 13,500 indicated horse-power was proceeded with. During the night she steamed up the English Channel, and soon after daylight was on the deep-water Admiralty measured run between the Dodman and Rame Head. This distance of 23 miles was run over four times, the mean speed averaging 19.7 knots. She then steamed out to sea and returned to anchor in Plymouth Sound on Saturday morning, the 4th inst., having completed a most satisfactory trial, the mean results being 14,046 indicated horse-power, with 109.1 revolutions, a coal consumption of 1.73 lb. per indicated horse-power, and a mean speed for the 30 hours of 20.1 knots. On Monday of this week the vessel proceeded on her eight hours' full-speed trial, when, as stated, the mean power was 19,156 indicated horse-power for 118.9 revolutions, against the 18,000 indicated horse-power for 120 revolutions required by the contract, and the coal consumption was 1.66 indicated horse-power per hour, a very good result. She afterwards steamed back to the Nore, whence, after carrying out the gunnery and circle-turning trials, she will be taken up to Chatham yard for completion for commission.—*Engineering.*

New Ships.

The supplemental programme of naval construction sanctioned by the House of Commons at Mr. Goschen's request on 22nd July last comprised four battle-ships, four cruisers, and twelve torpedo-boat destroyers. The contracts for the four battle-ships and two of the cruisers have now been given out. The Thames Ironworks and Shipbuilding Company has secured the contract for the construction of two of the battle-ships and their machinery, and the other two battle-ships with their machinery will be built by Messrs. Laird, of Birkenhead, and the Palmer Shipbuilding Company, at Jarrow. The contracts for the two first-class cruisers, which are to be of the large armored type, foreshadowed by Mr. Goschen in his speech in the House last June, have been allotted to the following firms: One to the Fairfield Company and the other to Vickers, Sons, and Maxim, at Barrow-in-Furness; while two others of a similar type are, it is reported, to be built at Devonport and Pembroke Dockyards respectively; the engines for the latter being supplied by Messrs. Humphreys, Tennant, and Co., of Deptford, London. Contracts for the remaining two cruisers, which will be of a somewhat smaller type, will be placed shortly.

The new battle-ships will differ somewhat from the Formidable class, but the differences will be mainly differences of detail. They will possess rather more speed than the Formidable class, and will draw somewhat less water. As Mr. Goschen significantly observed: "They will be more calculated to pass through the Suez Canal without lightening." Another point of difference is that the new battle-ships will carry slightly less armor. At present names have not been found for the new vessels. The fact that two of the new vessels are to be built by the Thames Iron-works Company is due entirely to tenders submitted, and with the exception of the Albion, launched last year, will be the first important orders executed by that firm for the Government for some years. In the present instance a circumstance greatly in favor of the builders is that they have two vacant slips side by side, one recently occupied by the Albion, and the other by the Japanese warship Shikishima. The two vessels to be constructed will be absolutely in duplicate, and can therefore be completed more expeditiously and at less cost than if they were of a different class. All four battle-ships are to be delivered in two years and three months from the date of the order, and if possible they are to be completed at an earlier date.

The two new cruisers will be of an improved Cressy type, and will be the largest and most powerful vessels of their class as yet designed for any navy. Their length between perpendiculars will be 500 feet; beam, extreme, 71 feet; mean draught, 26 feet; displacement, about 14,100 tons; speed, 23 knots; H. P., 30,000; armament, two 9.2-inch guns with armored shields, sixteen 6-inch Q. F. guns in casemates, fourteen 12-pounder Q. F. guns, three 3-pounders, and two submerged torpedo-tubes. The protection to the 9.2-inch and 6-inch Q. F. guns will be equal to that provided in the Powerful and Terrible. The guns will be of the more modern type adopted for the Cressy class, and of considerably greater power than those of any other cruiser. The 9.2-inch guns will be mounted in barbettes, protected by 6-inch nickel-steel armor, with 6-inch hoods; there will be four more 6-inch guns than in the Cressy, and they will be mounted four on each side on the main deck in 6-inch casemates, and four immediately above them on the upper deck, similarly protected. The sides will be protected by 6-inch steel armor, extending forward to the ram, where it will be of somewhat lessened thickness, while at the after-end of the belt there will be an armored athwartship bulkhead of 5 inches. There will be two armored decks, the upper one horizontal, of 1-inch steel, and the lower turtle-backed, of 4-inch steel, tapering to 2 inches. The steel hulls will be unsheathed. The measured-mile speed on an eight hours' trial with natural draught will be 23 knots. The continuous sea-speed with smooth water will be 21 knots. Water-tube boilers will be adopted and twin screws. The capacity of the coal bunkers will be 2500 tons, thus giving them a greater radius of action than the new cruisers of foreign navies. Both ships are to be completed in two years and six months at the outside.

It will thus be seen that the new ships will be unexcelled both as regards protection and speed. It is true that both France and Russia are building a certain number of so-called 23-knot cruisers, but this speed is only to be maintained for 12 hours, and that through forced draught, while in our ships the 23 knots will be obtained under natural draught, and judging from the good results obtained from the Terrible, there will in all probability be no difficulty in getting and maintaining this speed. On the other hand, the sea-speed (under natural draught) of both the French and Russian ships is only to be 19 knots as against the 21 knots of our ships, and in this connection it may be as well to recall that quite lately the Diadem ran home from Gibraltar with a foul bottom at a mean speed of 19.7 knots.—*Journal Royal United Service.*

[FRANCE.]

THE FRENCH SUBMARINE BOATS.

The mystery surrounding the submarine torpedo-boats being constructed in France is obviously calculated to provoke a good deal of curiosity as to the special features of this new type of vessel. Selected among the various projects which were some time ago submitted in competition, the boats are expected by French engineers to prove remarkably destructive, and to effect "an entire revolution" in naval strategy. These claims have been so frequently made by designers of new types of fighting machines in France, that one is inclined to be sceptical as to whether the submarine boat is capable of doing any practical work. Nevertheless, it cannot be overlooked that the performances of the Gustave Zédé in the harbor of Toulon have given a good deal of satisfaction to naval experts on the other side of the Channel, who declare that there are great possibilities in the way of submarine fighting. During the past few days M. Lockroy has visited Toulon in order to witness the manœuvres of the Gustave Zédé, which successfully repeated its performances of a week or two previously. Appearing about 500 metres from the Magenta to take aim, the boat sank before the guns could be trained on it and appeared 300 metres nearer, when, according to one account, it accomplished the extraordinary exploit of sending a torpedo "in an absolutely straight line between the funnels of the battle-ship." The French journalist remarks that had the torpedo been loaded the Magenta would have gone to the bottom. Having theoretically sunk the battle-ship, the Gustave Zédé disappeared and came to the surface again 100 metres behind the vessel. It appears that the manœuvring was so rapid that the gunners were utterly nonplussed, not only by the instantaneous and erratic appearance, but also by the small target offered when at any distance. There was a general impression that it was extremely difficult, if not impossible, to sink the torpedo-boat. Nothing, of course, is known as to the details of construction, since these are being kept a profound secret. It is, however, possible to exaggerate the importance of the much talked-of "eye," as we presume that this is merely an improved form of lookout with, perhaps, electric reflectors, throwing a strong light ahead. In any event, it obviously cannot be used for getting the bearings under water, as the tactics of the boat are invariably the same; that is to say, it rises about 500 metres from the vessel to be attacked, and, after taking aim, sinks; and, continuing in a straight line, reappears 300 metres further on, when it discharges the torpedo. It is obvious, too, that the difficulties of hitting a battle-ship would be considerably increased if it were steaming instead of remaining still, as was the case with the Magenta. The boat trains its torpedo at a distance of about 500 metres, and travels under water 300 metres before discharging. Supposing the submarine boat makes eight knots after aiming, by the time it rose to the surface the battle-ship would be half a mile away. In the event of the boat appearing ahead, so that the battle-ship would not have time to put about, it would still have to calculate the probable movements of the vessel, and during the time it took to train on there would be every prospect of the boat being sunk. The hitting of a battle-ship under full steam would be merely a matter of chance. Again, the Gustave Zédé being propelled by electricity stored in secondary batteries, can only have a very small range of action, and could, indeed, scarcely leave the ports. This is why French engineers are giving special attention just now to the Narval, which, it is expected, will be completed in the course of two or three months. It is being built upon competitive designs sent in by M. Laubeuf a marine engineer. This vessel will be propelled at the surface by steam, and under water by electricity. The small engine not only works the propeller but operates a dynamo which charges secondary batteries. When the boat is to go under water the funnel is unshipped and the boat is propelled by electrical power. It is said that the Narval will carry enough fuel to steam 252 miles in twenty-four hours at 12 knots, or 624 miles in seventy-eight hours at eight knots. Under water it will do 25 miles at eight knots. Though it may be doubted whether these boats will be anything like so practical and efficient as French marine engineers claim for them, it would yet be unwise to depreciate them unduly, and they are certainly interesting as showing the direction in which trans-Channel engineers are endeavoring to strengthen the marine. As France finds it hopeless to keep pace with England in naval construction, she is obviously bent upon changing her tactics, which are something like those of the sword-fish attacking the whale. The results obtained in this country and in Turkey several years ago with Nordenfeldt boats were quite as good as those obtained in France, but the whole scheme collapsed.—*The Engineer.*

[JAPAN.]

ASAMA.

The twin-screw cruiser Asama, recently built by Messrs. Armstrong, Whitworth and Co. to the order of the Japanese Government, from the designs of Mr. Philip Watts, the head of the Elswick shipyard. She is 408 ft. long and 67 ft. wide. With her powerful armament, strong defensive armor, and high speed, the vessel forms a most important addition to that formidable navy which is growing up so quickly in the Far East; a navy which is not only strong in its number of vessels, but also in the high efficiency of the separate ships, the professional attainments of the officers, and the seamanlike character of the crews.

This cruiser has no less than 2100 tons of armor worked into her construction. She has a belt of Harveyed steel which extends 2 ft. above and 5 ft. below the normal water-line, and tapers from 7 in. in the thickest part to 3½ in. at the ends. Above this the sides are protected by 5-in. armor which extends over the whole of the midship part and joins the armored bulkheads that connect with the main gun positions. The latter are protected vertically by 8-in. Harveyed steel plates, with an additional inner skin 1 in. thick, there being a 1-in. roof. There are ten casemates of 6-in. Harveyed steel. To protect the bow torpedo discharge there is on each side 6-in. plating, which extends from the stem 25 ft. aft. The armored deck is 2 in. thick and is curved in an athwartship direction to join the lower edges of the belt. There is a 2-in. steel plate worked forward to support the lower part of the ram bow, the armored deck extending forward to strengthen the upper part in the usual way. There is an armored conning-tower forward and an armored observation-tower aft. The armament consists of four 8-in. quick-firing guns mounted in pairs in the armored positions referred to forward and aft, as shown in our illustration. The forward guns are 25 ft. above the water-level, and the after pair 1 ft. lower. There are fourteen 6-in. quick-firing guns, ten of which are placed in the 6-in. steel casements before referred to. On each side of the ship two are placed at each end of the armored citadel, one above the other, as is shown in the engraving. This accounts for eight of the 6-in. guns, the remaining two of the ten in casemates being placed on either side of the ship on the main deck. The other four of the fourteen 6-in. guns are on the upper deck and are protected by shields. The lighter armament consists of twelve 12-pounders and various other weapons of lighter nature. There are five torpedo-tubes for 18-in. torpedoes. One of these is through the stem, and is protected as stated, whilst the other four are under water discharges.

The machinery for the Asama has been supplied by Messrs. Humphreys, Tennant and Co., and is generally of the usual type, there being two sets of inverted direct-acting engines and cylindrical boilers, pressed to 150 lbs. to the square inch. The legend power is 13,000 indicated horse-power with natural draught and 18,000 with forced draught, whilst the corresponding speeds are 20 knots and 21¼ knots. The normal coal capacity is 700 tons, and with this weight on board the draught is 24 ft. 8 in.; but there is storage for 1450 tons if all bunkers are filled.

The Asama has more than exceeded the contract conditions, running for six hours with open stokeholds when the horse-power was somewhat above the 13,000 and the revolutions 140 to 142 per minute, at which the speed registered was 20.37 knots. On the forced-draught trials 19,000 indicated horse-power was reached, the revolutions averaging 158 per minute and the speed being 22.07 knots. The gunnery trials and anchor trials have also been successfully carried out.—*Engineering.*

[United States.]

Albany.

The protected cruiser Albany, which has been built for the United States Government by Sir W. G. Armstrong, Whitworth and Co., Limited, at Elswick, Newcastle-on-Tyne, was launched on Saturday afternoon the 14th inst. The Albany is a sister ship of the Amazonas, which the Elswick firm built for the Brazilian Government, and which was launched in December, 1896. Last year the Amazonas, on her completion, was transferred to the United States flag, and, under the name of the New Orleans, took part in the war with Spain. The Albany is of the following dimensions: Length on the water-line, 330 ft.; length over all, 358 ft.; extreme beam, 43 ft. 9 in.; mean draught on a trial displacement of 3500 tons, 16 ft. 10 in. She has a protected steel deck extending from stem to stern, and is fitted with 14 water-tight bulkheads extending up to the berth deck. In addition to these divisions, she is fitted with a double bottom, minutely subdivided into watertight compartments; and the store rooms and coal bunkers below the protected deck are also watertight. The armament of the Albany is as follows: Six 6-in., four

4.7-in. guns, ten 6-pounders, and four 1-pounders. There are two machine guns for use in the boats and in landing and in the military tops. The vessel is fitted with two military masts, with two tops in each mast. The propelling machinery, which is being built by Messrs Hawthorn, Leslie and Co., Limited, at their St. Peter's Works, consists of two sets of triple-expansion engines, driving twin-screws, the maximum indicated horse-power being 7500, at 160 revolutions per minute, the guaranteed speed being 20 knots. There are four double-ended Scotch boilers. The vessel will be lighted by electricity, the plant consisting of three dynamos and engines.—*Engineering.*

Battle-ships and Monitors now Building for the Navy.

There are now completed and in commission in the United States Navy five battle-ships, four of which are of the first and one of the second class. These are the Oregon, Indiana and Massachusetts, of 10,288 tons, and the Iowa, of 11,410 tons, first-class battle-ships, and the second-class Texas, of 6315 tons.

There are now building in our yards eight first-class battle-ships of over 11,000 tons, whose aggregate displacement is 94,125 tons. As the aggregate displacement of the battle-ships now in commission is about 60,000 tons, it will be seen that we have over 50 per cent. more tonnage of battle-ships in course of construction than took part in the operations of the late war.

These eight vessels represent three successive naval appropriations. The Kentucky and Kearsarge were authorized in 1895 and are about ready to undergo their steam trials; the Alabama, Wisconsin and Illinois were authorized in 1896 and are about 60 per cent. completed; while the Maine, Ohio and Missouri were authorized last year and are in the early stages of their construction.

Judging from the rate of progress achieved in the past, we may expect to see the first-named ships in commission by the close of the present year; the three Alabamas by the close of 1900, and the Maine with her mates in the winter of 1902-03.

In addition to these fine vessels, we unfortunately have under way four ships of an obsolete and discredited type, which will be known as the Arkansas, Connecticut, Florida and Wyoming. They are monitors, pure and simple, and represent a class of ship which was built in the early experimental stages of warship construction, when designers were feeling their way toward the ideal fighting ship as represented by the eight battle-ships above mentioned. These four monitors were ordered by Congress in the face of the opinion and advice of the men who design and the men who fight the vessels of our Navy. The fact that we are committed to the construction of four of these archaic curiosities serves to show to what absurdities Congress can be committed when it sets up its own judgment against that professional opinion which should guide it in such purely technical questions as those of warship design.

Including the monitors, we now have under construction the twelve armored vessels which our artist has shown grouped together in the accompanying illustration. As each of the ships is drawn with careful attention to detail, particularly in the matter of armament, the group conveys an impressive idea of the exceptional offensive qualities of the forthcoming addition to our Navy.

The particulars of the ships are given in the accompanying tables, from which it will be seen that, while there has been a reduction in the weight of the main battery, there has been a remarkable increase in the weight of the intermediate battery, the latter being so great as to render the total energy of gun-fire enormously greater in the latest ships of the Maine class.

Name.	Type.	Displacement in Tons.	Speed in Knots.	Armor.		Armament.	
				Belt.	Turrets.	Main.	Intermediate.
Kentucky	First-class battle-ship	11,525	16	13¾ in.	17 in.	Four 13-in.	Fourteen 5-in. rapid-fire.
Kearsarge	"	"	"	"	"	" "	" " "
Alabama......	"	"	"	"	"	" "	" 6-in. "
Wisconsin	"	"	"	"	"	" "	" " "
Illinois	"	"	"	"	"	" "	" " "
Maine	"	12,500	18	12 in.	14 in.	" 12-in.	Sixteen " "
Ohio	"	"	"	"	"	" "	" " "
Missouri	"	"	"	"	"	" "	" " "
Arkansas	Monitor	3,100	12	11 in.	11 in.	Two 12-in.	Four 4-in. "
Connecticut ..	"	"	"	"	"	" "	" " "
Florida.	"	"	"	"	"	" "	" " "
Wyoming.....	"	"	"	"	"	" "	" " "

Taking the vessels in the order of their advancement toward completion, we have first the Kentucky and the Kearsarge, whose dock steam trials have already taken place. Comparing them with the Oregon type before them and the Alabama type following them, they represent a transition stage. In the Oregon we have an unprecedented development of the armor-piercing gun and a weak intermediate battery. In the Alabama we see a reduction in the number of armor-piercing and a proportionate increase in the intermediate rapid-fire battery. In the Oregon were four 13-inch and eight 8-inch armor-piercers, while the intermediate battery consisted of only four 6-inch, and these were originally slow-firers. In the Alabama the 8-inch guns have been thrown out entirely, and the weight has been put into an extremely powerful battery of fourteen 6-inch rapid-firers. Now this change, which is in agreement with the course followed by other navies, was gradual, and in the Kentucky and Kearsarge we see the intermediate step, for in these ships four of the 8-inch guns are retained, and the demand they make upon the displacement of the ship is shown by the fact that the intermediate battery consists of 5-inch instead of 6-inch guns. As the total weight of guns, mounts, ammunition, etc., for a 6-inch is about double that required for a 5-inch gun, it is evident that the retention of the four 8-inch guns necessitates the use of the lighter guns in the broadside rapid-fire battery.

The most novel feature in these ships is the double-deck turrets for the main battery. They were adopted after much discussion, in which it was argued that the 8-inch guns would not be capable of training independently of the 13-inch guns below them, and that one lucky shot might put half the main battery out of action by disabling both guns. To which it was replied that the great economy in weight and the unequaled protection afforded the 8-inch ammunition hoists, more than compensate for the risks incurred. The performance of these turrets will be watched with great interest, and we shall not be surprised if they are repeated in some modified form in future ships.

The weakest feature of the Kearsarge is that it sits very little higher in the water than the Oregon—a feature which would greatly hinder it in chasing an enemy to windward. In the Alabama class, ships of the same tonnage, this is rectified by the addition of a spar deck, which extends aft for three-quarters of the ship's length. This raises the freeboard to about 20 feet forward as against 13 feet aft, and enables the forward 13-inch guns to be carried at an elevation of 26 feet above the water-line. A further improvement over the Kearsarge is shown in the wider separation of the intermediate battery, which is rather crowded in the earlier ship and might be entirely wrecked by a single 12-inch shell. Eight of the 6-inch guns are carried on the main deck within the 5½-inch armored citadel, four are placed behind 5½-inch armor on the spar deck above the citadel, and two are carried in 5½-inch sponsons forward on the main deck. This is a far better arrangement. The guns would take longer to silence and the danger of panic is reduced. While the total muzzle energy of the metal thrown from one broadside in five minutes works out as practically the same as that of the Kentucky, the greater carrying power of the 6-inch over the 5-inch gun would render the fire of the Alabama more destructive at ordinary fighting ranges of 2000 to 3000 yards.

	Displacem't. Tons.	Main and Intermediate Batteries, Broadsides.	Weight of Shell in Pounds.	Foot-Tons, Energy per Shot.	Speed of Fire.	Total Energy of Broadside for Five Minutes in Foot-Tons.
Kearsarge	11,525	Four 13-in.	1,100	33,627	One per 2 minutes	Brown powder....... 336,270
		Four 8-in.	250	8,011	One per minute	" " 160,220
		Seven 5-in. rapid-fire	50	1,834	Eight pr. minute	" " 513,520
						Total brown powder 1,010,010
						" smokeless " 1,450,000
Alabama..	11,525	Four 13-in.	1,100	33,627	One per 2 minutes	Brown powder....... 336,270
		Seven 6-in.	100	3,200	Six per minute	" " 672,000
						Total brown powder 1,008,270
						" smokeless " 1,569,000
Maine.....	12,500	Four 12-in.	850	48,000	One per minute	Smokeless powder. 960,000
		Eight 6-in.	100	6,000	Eight pr. minute	" " .. 1,920,000
						Total smokeless powder .. 2,880,000

In the Maine class we see a greater advance than in any other ships of the new Navy. These remarkably fine vessels embody the experience gained during our late war, and in them, moreover, we have not hesitated to adopt some of the best features of foreign practice. The most important advance has been in speed and armament. The grave defect of the five ships already described is their low speed of 16 knots, which is from 3 to 4 knots less than that of some foreign battle-ships now building or in commission. It is due largely to the efforts of Commodore Melville that the Maine and her sisters are to steam at 18 knots instead of the 16 knots originally proposed. The result is to be obtained by giving them an increased length of 20 feet to accommodate the more powerful machinery. Another important modification that practically doubles the fighting power, as compared with the Alabama, is the introduction of smokeless powder and improved rapid-firing ordnance. The 12-inch guns will be of great length and will show the high velocity at the muzzle of 3000 feet per second, the same velocity being called for in the 6-inch rapid-firers. The muzzle energy of the 12-inch gun will be 48,000 foot-tons, as against 25,985 foot-tons for the 12-inch guns of the Iowa, and 33,627 foot-tons for the 13-inch guns of the Alabama. The 6-inch guns will have about 6000 foot-tons energy, as against 3204 foot-tons for the old slow-fire 6-inch weapon. The new energies therefore represent an increase of nearly 100 per cent. over the old weapons firing brown powder.

The new guns will be provided with improved breech mechanism of the Weling pattern, the rights of which were recently purchased from Maxim-Vickers for $200,000. The rates of fire will be greatly increased thereby, so that here again will be a large addition to the fighting capacity.

In the accompanying estimate of the total energy of broadside fire in one minute the rates of fire are calculated from actual results obtained. They are, in the case of each ship, the best that could be obtained by trained crews. As a matter of fact, such a fire will never be sustained for five minutes, but the table serves the end of showing the vast increase of power and rate of fire in the case of the Maine due to smokeless powder and improved breech mechanism. Unless the 13, 8, 6 and 5-inch guns originally designed for the Kearsarge and Alabama classes are modified to suit the new smokeless powder, the Maine will be theoretically nearly three hundred per cent. more powerful than the earlier ships.

Experimental work, however, is being done with the 13-inch gun, and in recent tests with smokeless powder an energy of about 44,000 foot-tons has been secured. The powder chamber has to be of less diameter and longer for the new powder, but there is no structural difficulty to prevent the change from being made.

The four monitors will have all the vices of their type. Their worst feature is that they roll so quickly as to make accurate shooting an impossibility. Admiral Sampson condemned them in his report of the San Juan engagement, and there is not a naval officer of the new school in our Navy that favors the type. The Arkansas and sister ships have only 18 or 20 inches freeboard, and in any kind of a sea their 12-inch guns, of which they carry two in a forward turret, would be half the time out of sight in the trough of the waves. The present designs are a modification of those first made, the ships having been lengthened 27 feet amidships to accommodate an increased supply of coal. The particulars of these ships will be found in the accompanying table.—*Scientific American.*

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ANNUAL REPORT OF THE SECRETARY AND TREASURER OF THE U. S. NAVAL INSTITUTE.

To the Officers and Members of the Institute:

Gentlemen:—I have the honor to submit the following report for the year ending December 31, 1898:

Itemized Cash Statement.

Receipts During Year 1898.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Dues	$1164 21	$292 63	$211 50	$271 12	$1939 46
Subscriptions	156 92	148 35	79 70	139 90	524 87
Sales	16 91	223 63	15 67	10 20	266 41
Interest on bonds and deposits.	204 09	9 00	45 50	45 27	303 86
Advertisements	76 25	198 00	194 00	46 00	514 25
Binding	11 00	5 40	2 00	7 50	25 90
Revenue stamps	..	..	..	04	04
Totals	$1629 38	$877 01	$548 37	$520 03	$3574 79

Expenditures During Year 1898.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Printing and binding	$433 57	$401 83	$643 25	$301 96	$1780 61
Salaries	284 00	316 00	300 00	285 60	1185 60
Stamps and postage	47 97	24 77	33 43	25 20	131 37
Expressage	3 85	1 00	76	1 75	7 36
Freight and hauling	3 04	3 70	4 29	8 89	19 92
Stationery	5 28	75	..	37 50	43 53
Office expenses, furniture	50	..	1 75	1 45	3 70
Prize Essay	100 00	..	..	..	100 00
" " Medal	16 25	1 03	..	..	17 28
Telegrams	1 47	2 78	30	50	5 05
Rent, Safe Deposit box	5 00	..	..	..	5 00
Rebate, C. A. Hunt	1 00	..	..	..	1 00
Purchase of back numbers	..	1 65	2 25	..	3 90
Expense Log of Gloucester	..	..	..	17 00	17 00
Packing Proceedings	..	..	..	10 25	10 25
Flowers, Lt. Dresel	..	..	..	10 00	10 00
Cost of papers for Proceedings.	..	..	..	55 00	55 00
Treasurer's expenses to Balto..	..	..	..	1 50	1 50
Totals	$901 93	$753 51	$986 03	$756 60	$3398 07

Summary.

Balance of cash unexpended January 1, 1898	$4448 28
Total receipts for 1898	3574 79
Total available cash, 1898	$8023 07
Total expenditures, 1898	3398 07
Cash unexpended January 1, 1899	$4625 00
Cash held to credit of reserve fund	59 14
True balance on hand January 1, 1899	$4565 86
Bills receivable for dues, 1898	822 00
" " " back dues	858 55
" " " binding	16 00
" " " subscriptions	109 44
" " " sales	2 80
" " " advertisements	203 00
Value of back numbers (estimated)	800 00
" " Institute property	100 00
	$7477 65

Reserve Fund.

United States 4 per cent. consuls, registered	$900 00
District of Columbia 3.65 per cent. registered bonds	2000 00
" " " Coupon bonds	650 00
	$3550 00
Cash in bank uninvested	59 14
	$3609 14

Membership.

The membership to date, January 1, 1899, is as follows: Honorary members, 5; life members, 109; regular members, 557; associate members, 187; total number of members, 858.

During the year 1898 the Institute lost by death and resignations 32 members; 10 new members' names were added to the rolls—7 regular, 3 associate; 1 life member; 1 regular member became a life member.

Members Deceased since Last Report.

Regular Members.

Rear Admiral D. Ammen, U. S. Navy, July 11, 1898.
Ensign Worth Bagley, U. S. Navy, May 11, 1898.
Ensign J. R. Campbell, U. S. Navy, May 30, 1898.
Chief Engineer H. H. Cline, U. S. Navy, October 5, 1898.
Lieutenant David Daniels, April 7, 1898.

Assistant Naval Constructor R. B. Dashiell, March 8, 1899.
Lieutenant H. G. Dresel, U. S. Navy, November 14, 1898.
Commander Horace Elmer, U. S. Navy, April 26, 1898.
Rear Admiral J. C. Febiger, U. S. Navy, October 9, 1898.
Ensign G. L. Fermier, U. S. Navy, November 19, 1898.
Lieutenant O. W. Lowry, U. S. Navy, March 13, 1898.
Lieutenant Commander S. C. Paine, U. S. Navy, December 21, 1898.
Lieutenant Commander E. W. Sturdy, U. S. Navy, June 6, 1898.

ASSOCIATE MEMBERS.

Mr. Lynward French, August, 1898.
Colonel J. W. MacMurray, U. S. Army, 1898.
Mr. Henri Schneider, 1898.

PUBLICATIONS ON HAND.

The Institute had on hand at the end of the year the following copies of back numbers of its Proceedings:

	Plain.	Bound.		Plain.	Bound.
Whole No. 1	141	..	Whole No. 45	40	17
2	150	..	46	37	17
3	46	..	47	19	2
4	131	..	48	38	8
5	115	..	49	10	9
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10	..	..	54	1	..
11	130	..	55	44	17
12	21	..	56	157	48
13	..	..	57	14	6
14	..	..	58	4	5
15	..	..	59	2	16
16	150	..	60	..	1
17	..	..	61	168	9
18	97	..	62	93	8
19	89	..	63	60	12
20	119	..	64	20	10
21	151	..	65	160	14
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29........	60	24	73........	19	12
30........	151	..	74........	150	16
31........	35	60	75........	150	18
32........	17	146	76........	150	17
33........	11	143	77........	190	16
34........	..	1	78........	161	1
35........	137	66	79........	200	13
36..... ..	150	44	80........	154	15
37........	150	21	81........	160	11
38........	146	1	82........	165	11
39........	150	..	83........	167	9
40........	38	103	84........	200	12
41........	152	18	85........	215	15
42........	127	17	86........	204	18
43........	151	9	87........	165	19
44........	45	7	88........	167	19

1 Vol. X., Part 1, bonnd in half morocco.

Very Respectfully,

GEO. F. COOPER, *Lieutenant U. S. Navy,*
Secretary and Treasurer.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HISTORICAL AND PROFESSIONAL NOTES ON THE NAVAL CAMPAIGN OF MANILA BAY IN 1898.

By CARLOS GILMAN CALKINS, Lieutenant, U. S. Navy.

The naval campaign of 1898 in the Philippines has only one defect when considered from the professional point of view. The contest was too short and simple to develop many technical novelties or to solve many problems of attack and defense. Yet the immediate results of Admiral Dewey's advance were so numerous and striking that the campaign deserves careful study. Between midnight and noon on May 1 our squadron forced an entrance guarded by a chain of barrier forts and by lines of torpedoes, destroyed a formidable naval squadron, and established a safe and convenient naval base in hostile territory. The same blow destroyed the commercial activity and the political supremacy of the capital of the Archipelago. Before darkness fell on that day's work the Captain-General of the Philippines had acknowledged that Manila lay at the mercy of the American Admiral. Without attempting to show the historical or political significance of these events, certain strategic conditions and tactical methods may be presented for discussion.

The President's order following the outbreak of war made the Philippine Islands our theater of operations and the Spanish squadron our immediate objective. The security of American commerce demanded the prompt destruction of the enemy's cruisers, and nothing less would serve to quiet disturbances of public opinion along the Pacific Coast of the United States. Conquest might wait, but Spanish ships could not be left at large to prey upon the carrying trade and to threaten our unfortified harbors. Of course naval officers generally were aware that the Spanish fleet was condemned to a short radius of action and incapable of enterprises oversea. It was also known in Hong Kong that the political situation of the Philippines made the revival of native insurrection an inevitable sequel of American aggression. This prospect helped to solve the problem of finding the Spanish squadron and relieved our chief anxiety.

It should not be forgotten that the first act of war in the Philippines was the capture of the ship Saranac near Iloilo on April 26. The Spaniards were eager to boast of their prize and fancied that our fleet must be crippled by the loss of her cargo of Australian coal. Fortunately, other arrangements had been made and, moreover, it turned out that the vessel was duly equipped with papers showing a transfer to the British flag, so the local authorities had to release her. As they meant to use like expedients for the salvation of their own steamers, their scruples were not unnatural. Curiously enough, this was the only attempt to seize a mercantile prize made by either side during the war in the Far East.

Meanwhile, the American cruisers had been forced to quit Hong Kong and were accused by Manila journals of "hiding their flag," and of wasting coal and hoarding ammunition. There had been some concern about docking and coaling the Baltimore within the limits of neutrality, but the subsequent delay had no other object than to await final instructions from Washington and the arrival of our consul from Manila. It was thought that he might bring some valuable information, but the operations which followed did not depend upon vague rumors and crude calculations gathered in the enemy's capital. Neither the number nor the location of the Spanish squadron of defense was known until the vessels were actually sighted, nor was any valid account of the shore batteries in the hands of Admiral Dewey when he steamed into the bay. As for the submarine defenses of Manila, they must remain an unfathomed mystery to the end of time.

The real problem was that of finding the enemy's ships. However defective they might be in offensive power and in mobility, they had their choice of a dozen harbors within a day's run of their naval base. The natural sortie harbor for the strategic defense of Manila Bay was obviously to be found in Subig Bay, about sixty miles northwest from Cavite. A fleet installed in this harbor would threaten an invader's lines of communication and compel him to keep his forces concentrated, thus limiting his activities in blockade and reconnoissance as well as in bombardment and the landing of troops. We knew that the strategic advantages and nautical convenience of Subig had been recognized by the location of a naval arsenal at Olongapo, and that a naval commission had been engaged for a dozen years in elaborating plans for the industrial and military equipment of this excellent harbor. Of the concrete results we had no definite information.

Yet it seemed that some measures of defense must have been executed before our arrival. There had been months of warning preceded by years of discussion. The natural conditions favored defense. The main channel was only a mile wide and it was commanded by numerous sites for batteries and barrier forts on Isla Grande and on the wooded bluffs along the western shores. This channel was rather deep for mooring mines and no confidence was placed in those which had been anchored in the entrance. For naval defense the position was admirable, as a curved line of vessels three miles long could deploy in deep water to envelop the heads of columns of attack and check their advance by concentrated fire. Such considerations induced Admiral Montojo to abandon Manila and Cavite on April 24, but his squadron was soon discouraged and hurried back to the miserable station under the guns of Sangley Point. The reasons for this hopeless retrograde movement are officially stated as follows: some ships proved unseaworthy, the Castilla leaking until her shaft-alley was packed with cement; the Ulloa was unable to leave Cavite and the Velasco unfit to join even a stationary line of battle; then, the excellent guns provided for the Isla Grande batteries were still unmounted after six weeks of baffling delay;

finally, the water was too deep, and lives as well as ships would be sacrificed at Subig. This amazing and unseamanlike notion seems to have had weight in a council of captains, and it appears to have leaked out to demoralize the crews, since we found it circulating among the Filipinos after we landed at Cavite.

When the scouting cruisers of our advance found this noble harbor unguarded we began to hope that the enemy might be found off Manila, although no nautical or strategical reason justified this expectation. Sentimental and political factors may explain concentration at the capital in spite of the superior advantages of Iloilo or any of the numerous harbors formed by straits separating islands and affording two or more channels of exit. Had one of these ports been held, the squadron would have retained freedom of action until the assailant felt strong enough to divide his forces and to deprive his detachments of mutual support. Since no port in the Archipelago was guarded by barrier forts, and since Spanish *torpedistas* could not trust their own work in submarine defenses, the squadron could only find security through strategic liberty and tactical vitality. Being unable to defend itself, no place could be found for it in the defensive scheme of open bays or uncovered towns.

Unless the combined batteries of ships and forts were trusted to beat off our attack on Manila, it was a strategic blunder to concentrate there. The capital was bound to be one of our objectives and the fleet another, and we might have been forced to make scattering reconnoissances involving risky tactics, random pilotage, and unprofitable expenditure of time and coal. Nothing but a superior defensive situation could justify the plan adopted, and Manila Bay afforded no such advantage. If any defense was in order the fight had to be made at the entrance, twenty-five miles from the city. As soon as the cliffs of Corregidor were passed the control of the bay and the protection of the city could be assured only by naval superiority. In obstructing the entrances by the Boca Grande and Boca Chica every form of defense might be made to co-operate, batteries ashore and afloat covering those weapons of the weak, torpedo-boats and submarine mines.

The American tactics of approach had been freely discussed before the fleet left Hong Kong. It had been proposed to attack in line abreast and to rely upon bow fire. The structure of many armored vessels and the disposition of their batteries might seem to favor this formation, but the modern view prefers a flexible column moving briskly along the line of fire and enveloping the enemy by superior speed and extended order, so that his huddled groups might be shattered by concentrated fire. The enemy's defensive attitude and his misplaced reliance upon covering batteries on his flanks promised to localize his squadron and he was found in the exact position which had been most carefully studied and diagrammed on the chart. The Olympia, with her heaviest guns in turrets disposed for fore and aft fire and for the protection of the intermediate batteries in end-on attack, was the only ship fit for a line abreast. Even with her the broadside fire was much heavier than that on the bows and, as three years of target practice had shown, her five-inch battery was as much superior to her turret guns in accuracy and endurance as it was in rapidity of fire. High authority had attempted to convince the division officers that eight-inch guns in similar turrets had been fired with good results at intervals of one minute. Investigation showed that loading and sponging required nearly two minutes and that pointing might impose many seconds of delay, especially at stationary practice. Better breech-blocks, more rigid shafting for sighting the guns, telescopes covering a four-times larger field of vision, and improved dry batteries for firing had greatly improved the operation of these turrets during the cruise, while division officers and engineers had been indefatigable in adjusting valves of the steam training-gear, and jolting had been nearly eliminated from the rotary motion of the turrets. Nor were the hydraulic cylinders scored by the pistons, nor the buffers jammed in ramming out, on this memorable occasion. Of the familiar drawbacks of target practice the smoking of telescope lenses was the most inveterate. The difficulty of finding the target, due to obscured and contracted outlook, may serve to explain the depressing fact that these guns, handled by well-trained crews directed by attentive officers, fired less than half as many shells as the Baltimore's similar battery mounted on old-fashioned carriages on bow and quarter. The Boston's pair in barbettes also beat the Olympia's four in turrets, in spite of vexatious delays caused by crippled locks. But the five-inch rapid-fire battery redeemed the situation by firing as many shells per gun during the hottest action as the two turrets were able to expend in a much longer period. There was a natural tendency to favor the heavier guns by maneuvering and by employing them at longer ranges. But the range-tables fail to justify this preference, and there was no obstacle to requiring the full penetration of even a five-inch shell.

Having decided upon an advance in column and the use of broadside fire, the line had to be lengthened to include the two purchased colliers and the unprotected revenue cutter, Hugh McCulloch. At sea these vessels had formed a second column parallel to the six cruisers. Darkness was preferred for running past the batteries at the entrance and the night was a favorable one. The moon was masked by light rain-clouds during the first watch, but the horizon line was always clear enough for safe navigation. The commerce of Manila mostly enters by the *Boca Chica*, or northern channel, because it is more convenient for the quarantine inspection from the station at Mariveles. Force has been used to compel ships to use this narrow entrance when the wider channel would have been more convenient, and myths concerning dangers to navigation in the *Boca Grande* have been circulated. None of these dangers are shown on the chart, and the honored name of Sir Edward Belcher guarantees the boldness of the water throughout the broader channel and about El Fraile in particular.

It was known that batteries had been installed on Corregidor Island and it was uncertain if there were any on the mainland on either side. There were reasons for mounting the guns well up the slopes of this island. Had they been near the summit, 600 feet above the water, they would have commanded both channels and been quite inaccessible to projectiles from modern rifled guns, except at ranges greater than three miles. At shorter distances there would have been no angle of fall to land shells within gun-pits or parapets. This consideration seemed to close the northern channel and drew our line three and one-half miles south of the central island and therefore within half a mile of the isolated rock El Fraile. This mass has little more bulk than the Olympia or Baltimore, and the latter often raised a vast pillar of cloud when her fires were cleaned. It is inconceivable that our line should have passed unseen had any lookout been kept along the shores. It was known that we were off Cape Bolinao at dawn and off Subig at 4 P. M. of April 30. The Commandant of Corregidor had appealed wildly and in vain for two gunboats to patrol the channels. One vessel lay near Mariveles and her signal lights were twinkling as we stood in. They were answered by a rocket from the summit of Corregidor, yet there was no firing until the Olympia had passed the narrows and entered the open waters of Manila Bay. Then the swing of her stern light, as she headed up five points, startled the gunners on El Fraile and drew their ineffectual fire. Shells whistled through the gaps in our column and drew a brisk fire from the Raleigh, Boston and Concord. Even the McCulloch fired her six-pounders. Some of our shells were seen to burst and the enemy's batteries soon fell silent.

Long afterward we learned that three batteries had been placed to command the Boca Grande while four guarded the Boca Chica. The Fraile battery was equipped with excellent breech-loading rifles, but its location seems absurd. The rock could have been surrounded and taken in rear; its guns were mounted with small train and had little stability; guns and their crews might have been buried by splinters from the rock which overhung them. Nature had separated the available sites too widely for co-operative effect upon an enemy maneuvering freely in open waters and in dispersed order. The defensive scheme was a weak improvisation, but abundance of resources and time would not have availed to make these approaches secure.

Much has been said of mine-fields in this channel. It was "full of torpedoes," according to Don Enrique Sostoa, Commandant of the Naval Arsenal at Cavite, and the Captain-General. The lines of torpedoes were all in place and the batteries ready to open fire on the night of April 27, according to Señor Garces, Colonel of Marine Artillery. But all the dispatches relating to torpedo defense indicate confusion and uncertainty. There was no gun-cotton and not enough pebble-powder; blasting-powder was demanded, along with insulating materials of all sorts. But depths of 30 fathoms in a channel five miles wide render this method of defense uncertain at the best. Under Spanish control the mines would be apt to go adrift, and they would certainly impair the morale of any fleet drawn up in rear of their lines. Countermining would have been easy had our ships been equipped therefor or our officers instructed in that essential art, which seems to have received little recognition in our technical schools. But no floating torpedo was ever discovered in Manila

Bay, nor was any search made, in spite of the amiable warnings of the naval authorities—warnings transmitted after the "withdrawal of the Spanish fleet" on the first of May.

As soon as our ships were clear of the danger space in the channels of entrance they commanded the bay with excellent anchorages anywhere within a circumference of sixty miles. This security led to some talk of clearing ship for action by getting rid of the boats. The Olympia had a dozen big wooden boats inconveniently arranged on cradles, requiring two hours' work of the ship's company, unassisted by steam winches, to launch them overboard. The other ships had their boats swung at davits and might have lowered them in a few minutes. Of course the danger from fire and splinters was recognized, but it was not convenient to do the work after dusk and the sighting of the Spanish fleet at dawn disposed of any notion of precautionary delays. Yet it must be held as a wonder that no damage was done to the boats by the enemy's fire and that our own fire was unobstructed by flames or fragments from these boats. Those carried outboard were generally wrecked by concussion, so that the Olympia had the advantage for this exceptional occasion.

The consular rumor had reduced the Spanish fleet to two vessels, one of them partly dismantled, and had led us to look for them near the breakwater in front of Manila. Our course was shaped to verify this strange report and Cavite was not reconnoitered in approaching from the westward. At five o'clock we were three miles west of the mouth of the river which divides Manila. Sixteen merchantmen were counted; no steamers, no cruisers, lay off the city. Not many minutes later the Spanish line was made out, stretching to the eastward of Sangley Point in front of the white buildings of the arsenal. Standing to the southward, parallel to the shore, the Olympia brought the enemy well on the starboard bow and our six cruisers stretched along in her wake, the colliers and the McCulloch being sent to the middle of the bay. No attempt was made to count the enemy's force or to identify individual vessels. Our own line was miscounted and the Helena was added to the list in the report of the Spanish Admiral. There was no occasion for close comparisons; general information served to convince us that our six cruisers could defeat all the vessels that Spain had in the Philippines, especially if they chose to lie massed and motionless within easy range of open waters deep enough for safe navigation. There were seven of them in line, as it turned out; two of them, the Castilla and Don Antonio de Ulloa, were moored with springs on their cables. The others steamed about in an aimless fashion, often masking their comrades' fire, occasionally dodging back to the shelter of the arsenal and now and then making isolated and ineffectual rushes in advance—rushes which had no rational significance except as demonstrations of the point of honor. They were mere flourishes of desperation inspired by defeat.

The Spanish ships were ready: they were cleared for action, and their crews animated by rounds of regulation cheers and the display of battle-flags, before the action began. The first shell came from Sangley Point and fell short by a mile or so. Extreme range was then tried and the shell splashed ineffectually, more than six miles away. These wild shots steadied our nerves, though the crews of the anchored merchantmen and the dwellers in the northern suburbs of Manila must have been startled by the projectiles fired across our track. One of the five 15-cm. breech-loaders on Sangley Point resented the strains of extreme elevation and broke loose from its mount with its sight set at 10,500 meters. As our line extended in front of the gray walls and white houses of Manila we were saluted by the roar of big guns from three principal batteries, which included four breech-loaders of 24-cm. caliber firing heavier projectiles than any guns in our squadron. Two of these batteries had the walled city as a background, while the third lay some 1500 yards to the southward on the borders of the Luneta promenade or execution ground, and the neat suburb of Malate. The leading ships disregarded this impertinent attack, but the Concord sent some shells close enough for a warning. The firing of these guns deprived the city of any right to protest against immediate bombardment. They continued to waste ammunition for some five hours, and the chief of artillery shot himself that evening to expiate his failure and his disobedience of orders, committed under the stress of an impracticable code of military honor laid down in obsolete regulations.

None of this random cannonading distracted our attention from the ships, and we soon saw them masked in clouds of white smoke. Our line of advance was beaconed by columns of spray where the shells sank or soared in erratic *ricochets*. The absolute inefficiency of all projectiles which fall short was to have abundant demonstration that day. The fire grew faster as we ran down our distance. When the range was estimated at 5500 yards the quiet consent of the commander-in-chief released the tension and the Olympia was jarred by the shock of one of the eight-inch guns in her forward turret. This shot was fired on the starboard bow and the ship did not swing to bring her port battery into play until she was within 4000 yards of the eastern ships in the Spanish line. Then the five-inch and six-pound guns poured in their rapid fire and the rest of our line turned and opened with their broadside batteries in due succession. Our shells rained all about the huddled enemy and many eyes watched eagerly and ineffectually for direct evidence that a due proportion of them were finding their billets.

Just as our line got fairly engaged a distracting element appeared. A small steam launch with awnings spread and a big Spanish ensign streaming astern, advanced from the cove behind Sangley Point, crossed the bows of the Olympia and then turned toward the shore as if to lie in wait for that formidable antagonist. There could be but one interpretation of this movement: this was a torpedo-boat, and she had to be treated as such. Secondary batteries began to pick up the range and their shells were soon veiling the target in spray and smoke. A few rounds were fired from even the main batteries, while the marines did all that may be accomplished with Springfields at 1200 yards range. Yet the reckless craft still floated, though no longer able to steam or disposed to use any weapon. She drifted ashore under the guns at Sangley Point, where she continued to draw fire from the six-pounders, in spite of keen remonstrance from high authorities, until the action was over.

It seems proved that the launch was no deadly microbe, but only a humble market-boat, manned by Filipinos and bound to Manila by direction of the English family residing at Cañacao. The literal oriental manner of executing domestic routine amid the shock and thunder of battle eliminates the heroic from an action of amazing rashness. But the moral of this incident is all on the side of genuine torpedo-boats. Here was a conspicuous craft slowly executing the traditional maneuvers of torpedo attack and awaiting the advance of a squadron not undistinguished in the annals of naval gunnery—a squadron which surpassed its enemy by a score of 100 to one. Yet the frail hull was not shattered, nor the boilers exploded. Even the crew escaped with their lives, though a shot had pierced the steam cylinder. The boat was repaired and fitted to carry generals by the time that American troops appeared on the scene.

After reducing this alarm to its lowest terms it becomes necessary to strike out all rumors of a second mythical torpedo-boat. No responsible witness has been found to locate or describe this apparition, although some fell into the natural error of duplicating the legend. Perhaps the erasing angel should also blot out the report of submarine mines exploded ahead of the Olympia before the ships opened fire. Such an explosion, miles ahead of our advance, could indicate nothing but panic. Against the testimony of many sincere eye-witnesses stands the statement of Captain Concha, commanding the Don Juan de Austria up to May 1. This intelligent and disinterested observer denies the existence of any submarine mines or the presence of any improvised torpedo-boat off Cavite. This statement leaves some of us face to face with illusions of vision or memory. One launch, the España, was more or less equipped with torpedoes in April, but she seems to have sought safety in some river to the northward of Manila, where the natives found her sunken wreck during the summer. Had there been half a dozen real torpedo-boats in Manila Bay in the hands of fearless and skilled officers the whole situation would have been transformed, and a defensive system of anchorages and patrols would have imposed constant strain and vast expenditure of coal and ammunition, with the probable loss of one or more ships to complete the account.

The pilotage of the American fleet through the channels of entrance and up the bay was a simple matter, in spite of the extinction of the five lights upon which navigators are accustomed to rely. Safe navigation during the action was a more delicate business. Cavite Bay is well surveyed and charted on a convenient scale, but grave doubts were attached to the soundings by notes in the Sailing Directions and on the chart. This reproach turned out to be unmerited, but a certain degree of caution was imposed thereby. The orders of the commander-in-chief required the Olympia, drawing 24 feet, to keep outside the five-fathom curve as laid down on the chart. As none of the other ships drew as much as the flagship they had only to follow and turn in her wake, which was curiously distinct, both by night and by day, in the oily smoothness of the bay. A careful quartermaster gave the soundings from the off-shore side and the ship's position was plotted from cross-bearings taken by the standard compass at frequent intervals. Growing familiarity with the soundings showed depths nearly a fathom greater than those marked on the chart during the morning tide of May 1, though proper reductions confirmed the printed record for the neighborhood of Cavite.

The Spanish line stretched nearly east and west inside of Sangley Point, while the five-fathom curve bent to the southward of west. Therefore, in running to the westward our column tended to converge toward the batteries. In fact, we turned off the point within 1500 yards of those guns which we had noted as ranging six miles. Once we were within 1200 yards, but hardly a hit was made, even when we turned in overlapping groups, presenting a huge gray mass as a target. Had the skill of the gunner who hulled the Baltimore with an armor-piercing shell been general among his comrades this might have been a rash maneuver. Of course, it was always open to us to pass at speed and turn out of range of the batteries ashore and afloat, as we did on the eastward runs. Had each transit across the firing arc begun with the column formed and intervals closed, the broadsides would have been more rapidly effective. Contempt for the incompetence of Spanish gunners justified in practice some departure from ordinary rules of prudence. Besides the boats on cradles or swung at davits there were other instances of manifest exposure, since the Olympia was steered from a wooden pilot-house on a wooden bridge covered by screens of painted canvas, and the shafting of the hydraulic steering-gear was not safe while thus connected. Captain Gridley found himself in close touch with the battery and engines while stationed in the conning-tower, and he could have conned the ship from that station with the assistance of an officer at the standard compass, though the bridge arrangement was a trifle handier. Obviously, these notes have no value or significance except with reference to future contests.

While our column kept sweeping along the five-fathom curve the question of ranges was settled by the navigation. The Spanish fleet received our fire from something less than 4000 yards in the eastern approach and the firing ceased at less than 2000 yards as we passed behind Sangley Point. The average distance was about 2500 yards, and no range could have been better adapted to the conditions. Six-pounders were thoroughly effective and five-inch shells could penetrate any obstacle offered by the structure of the enemy's ships. Shortening the range at an early stage of the fight might have invited injury to our ships as well as loss of life. The usual methods of range-finding were as baffling as ever; the only electric range-finder failed after the first round; the stadimeter or sextant could not be used without more knowledge of masthead angles than was available, especially as topmasts were generally housed. It was always easy to determine our own position, but the enemy's was never accurately marked on the chart. The Olympia's reckoning placed it too far inshore, and, therefore, gave ranges in excess by 200 yards or more, yet many of her shots were noted as falling short, and the ranges used in some other ships seem to have been greater throughout the action. No one in the Olympia was gifted with the vision required to mark the fall of rapid-fire projectiles, and an equal uncertainty attaches to all her eight-inch shells except one which was officially recorded as striking the stern of the Reina Cristina. Under these conditions range-finding by the secondary battery was illusory at Manila, as Lieut. Hill demonstrates it was off Santiago.

Our movement across the line of fire assisted in drawing each ship clear of her own smoke and the intervals of 400 yards allowed each cloud-bank to be dissipated before fouling the next ship in line. Still this escape was only relative, and there was much residual annoyance. The telescopic sights of the turret guns required incessant wiping and the rate of fire was much reduced by their dimness. Smokeless powder offers a remedy, but the variety used by us on August 13 substituted red smoke for white without much reduction in density. That day's work demonstrated the drawbacks of stationary practice, even with improved powder. The advance of the ship also assists lateral pointing, as the motion is steadier than that given by the rotating gear, which involves too many shocks and surges, especially when hundreds of tons of turret armor have to be revolved by steam.

Our diagonal advance also served to disconcert the aim of our unskilled opponents, as they lack sliding leaves for correcting the aim. One captain has told us that he told his men to fire at the stem of the Olympia during her passage. This calculation seems to promise an occasional hit, but none were counted. The elevations were, perhaps, even more difficult; we have little reason to think that any measurements were attempted, although a correct memorandum of the heights of the Olympia's funnels and superstructure was found at the arsenal. The batteries at Manila had wooden azimuth circles and telephones which should have enabled them to plot our tracks; they had nearly five hours practice, but no amount of deliberation or persistence enabled them to score, even while we were drifting about, with crews at breakfast, within the radius of their fire. Altogether, there is little to be learned from a study of Spanish methods or theories of gunnery.

Of the enemy's tactical disposition it is impossible to speak with more favor. Since the ships could not maneuver and there was too much risk in fighting in deep water, a place of refuge was what they had to seek. This could only be found where the front could be covered with mine fields and the flanks guarded by batteries or shoals. Manifestly, the distance of five miles separating Sangley Point from Manila was too great for combined effect of shore batteries or for obstruction by fixed torpedoes. Yet the line selected was a section of this long curve, and it was thrown so far to the northward that we were able to steam along a nearly parallel line in deep water and without changes of course at the most effective range of 2500 yards. This practically made the affair a duel between two squadrons, with the stronger at liberty to utilize every element of superiority. The American ships might even have refused close action with the battery on Sangley Point without neglecting the eastern end of the Spanish line. A resolute scheme of defense might have made Sangley Point the key of the whole situation by covering it with earthworks and mounting all the best guns from the useless walls of Manila, distributed for large arcs of fire. Our experience in silencing such batteries was not encouraging, and the task would have been harder had the enemy's fire been rapid and occasionally effective. Had this flank been guarded, the line could have drawn backward toward the arsenal and the village of

Bacoor, with each ship in the shallowest water suitable for her draught. This would have compelled us to advance in line, feeling our way by the lead and fretting about torpedoes. Our larger ships would have been forced to engage the shore batteries while those of lighter draught stood into the bay. The spirited guidance of the flagship depended upon actual leading and could not have been maintained by signalling, and fleet evolutions would have been impracticable. After advancing bows on until entering the arc of punishment—and surely there must have been such a space somewhere under the Spanish guns—each ship might have to turn, under every moral and material disadvantage, to withdraw to a position where marksmanship would recover its value.

This plan requires no material resource not actually available at Manila. A dozen serviceable breech-loaders and nine rifled mortars lay along the walls of that city, and there was enough torpedo material to make these shallow waters dangerous for a season. Possibly there was some lack of co-operation between army and navy in defense; possibly some futile political notion tied the guns to the absurd water batteries of the capital. Perhaps it was realized that defeat was inevitable, and everybody was engrossed with the salvation of his military honor without regard for concrete results. Tactical defeat was inevitable if the battle was to be fought out in Manila Bay, but a few lucky shots might have checked the invasion or inflicted injuries compelling temporary withdrawal and strategic defeat. Arbitrary rules of military honor and futile chances of individual heroism are as nothing compared with rational and resolute plans for enduring to the end. But Spanish history is written in another sense. "To breed men and waste them" is the awful tradition of the ancient Kingdom of Castile.

Animated by desperate counsels, Spanish vessels had made one or two attempts to advance to meet us in front of their line. Only one of these efforts was persistent or significant enough to be remembered. As we stood to the eastward on our third passage along the zone of fire the Reina Cristina, bearing the flag of Admiral Montojo, was seen to detach herself from her consorts and to approach a gap in the line with the apparent purpose of coming to close quarters with the Olympia, which had just changed her course sixty degrees to the southward of her previous tracks toward the turning point. The two flagships seemed closing rapidly, but the Spaniard had only advanced a ship's length or so beyond his line before his progress was arrested by a hail of concentrated fire which produced immediate and visible results. His speed slackened; smoke puffed out forward and aft; a white plume of escaping steam showed that his motive power was crippled, and an awkward turn, exposing the unprotected stern, suggested that his steering-gear had met the same fate. The beaten flagship crept toward the arsenal, where she grounded, burned and blew up during the morning. We all saw that she was disabled, but it required some hours to demonstrate her destruction.

Hitherto there had been much disappointment among those who tried to observe the effect of our fire. Some of the gunboats had seemed to flinch and had dodged in and out near the arsenal. The white bulwarks of the Castilla had been scarred and blackened by our fire, but even her wooden hull had not burst into flames after two hours of brisk bombardment. Annoyed by this delay in destruction the commander-in-chief had decided to try the effect of stationary practice. The signal was made to prepare to anchor; the Petrel was warned to detach herself for turning the eastern end of the Spanish line. The station selected for the Olympia lay well inside the five-fathom curve and within 2000 yards of the center of the enemy's position. The course had been changed to southeast when the Cristina's advance was noted. Since she had to be met underway the signals were annulled. Anxiety in regard to the swinging of the ship when anchored was thus removed; it was a case for applying the maxim, "Ef know wind and know tide, know telling," written by an aspiring but unliterary mariner during the present year of grace. Doubtless the time for closing and finishing with the enemy was at hand, but the experiences of target-practice, supplemented by that of this action, fail to show that any advantage would result from anchoring. Twin screws enable vessels to be pointed as well as to be held fast in their stations. But the circling movement in column had not failed in practice and might have been continued until resistance was crushed. In fact, one more turn was made and our ships passed to the westward of Sangley Point in unchanged order.

It has been assumed by remote interpreters of the lessons of this contest that the Spanish fire was promptly silenced or smothered by the superiority of our broadsides. There was a visible falling-off in the rapidity of the enemy's shooting, but, judging from our own experience, we attributed this to the expenditure of accumulated stores of ammunition—our decks were soon cleaned of great mounds of rapid-fire shells—and to the obstructive effects of smoke. In accuracy the Spanish gunners had neither gained nor lost; they could drop shells close alongside or they could send them soaring aloft. But each ship seemed to carry its own charmed circle—not always of large circumference either, since one seemed to count a hundred shells within a ship's length during the two hours of actual combat. Of course, these shells, which burst before our eyes, scattered radial showers of fragments which cut rigging and scored spars, and there is a record of some half a dozen actual hits, though nothing larger than a six-pounder accomplished both penetration and explosion. But the fact remains that the enemy was not silenced after two hours' work, and that none of his ships were structurally destroyed or obviously disabled during the period when our fire was returned.

Since there has been so much public discussion of the motive for hauling off to the northward and discontinuing our fire at 7.30 A. M., it may be well to submit a reconciling statement to harmonize popular notions with official records. We did not stop fighting because our men were hungry, and there was no shortage of ammunition. Nevertheless, some 1700 Americans did eat a hearty, though scrambling, breakfast during the next hour. The last meal seemed to belong to a different historic epoch, although the Olympia's people had had lukewarm coffee at four o'clock. Some ships' companies had missed even that unsatisfying refreshment. Few were glad to stop fighting, even for the sake of food, but all had a general sense of victory, though details remained questionable and the enemy's flag was still aloft when we ceased firing. It is true that there was some concern over the state of our ammunition rooms until the task of restowing and counting was completed. The weak point in the Olympia was the supply of shell for her ten five-inch rapid-fire guns. These splendid weapons had consumed 350 shells in two hours—nearly forty per cent. of the original supply. But a mere verbal misunderstanding had carried a more depressed account to those in authority, and the resulting inquiry consumed time and interrupted the battle. The eight-inch guns could hardly have expended their projectiles in a week's fighting and the six-pounders were equally overstocked. The Bureau of Ordnance had sent out new stocks of ammunition by the Baltimore, arriving in Hong Kong just in time for distribution among the vessels in the fleet, and further supplies were promptly dispatched in the Charleston and the City of Peking. A revision of allowance tables, giving due recognition to the demands of the rapid-fire guns of main batteries in preference to the slower armament of the turrets, is the only amendment suggested by this test.

The shock of two hours' incessant firing served to deafen many people—especially those who stood on the planking of the bridges. Within the conning-tower and aloft on the grating above it, where the commander-in-chief took his station, this jarring effect was not felt. But it required much energy and emphasis to con the ship and to pass orders to the batteries by word of mouth. Telephones were out of the question and voice tubes uncertain. Even the articulation of many files of marines did not prevent occasional confusion. A system of dials for indicating ranges should be installed as soon as electrical science is ready to equip them. The impression produced by visual indications is far less fugitive and uncertain than those depending upon hearing. Considerable signalling by the navy code was carried on during the action, but the flagship's example was far more impressive than any secondary method of control. Signals were not always made out—or, at least, not always answered with promptness, and the appeal to "close up" was frequently and effectively displayed. Tactical movements in column seem practically independent of exactness in signalling.

Before the hostile squadrons separated the Spanish ships had visibly suffered from fire, especially the Cristina and Castilla. The latter was the only wooden vessel engaged, but all the others, including the American cruisers, were full of inflammable material. Two curious fancies relating to fires seem to have attacked the imagination of Spanish journalists; they alleged that their ships were all of wood dried to tinder by tropical heat, forgetting the dampness of the Philippine climate; then came the fancy that we used incendiary projectiles forbidden by all laws, human and divine. Our shells were to be scraped and their coating analyzed for conviction on this charge. A complete demonstration of the incendiary effects of even the smallest rapid-fire shell was given when the Chinese squadron was destroyed in the Min River in 1885. Our experiment was really much less striking; many shells burst in wood-lined spaces with amazing effect in producing splinters but without combustion. This seems to have been the case in the commandant's house at Cavite Arsenal as well as in the ward-room of the Boston, where a six-pound shell shattered furniture and smoked an officer's clothing without appreciable scorching effect.

Of the other elements which make batteries efficient let us first consider the accuracy and rapidity of fire. It is well to avoid dogmatizing over comparisons or basing technical assertions upon sentimental data. In accordance with familiar and obvious principles of naval gunnery we find that the number of fires and the percentage of hits diminish as calibers increase. Rapid-fire ammunition and improved mechanism are apt to justify themselves. The rotation of armor is a costly burden in pointing and gun-captains aim better when they are not shut up in turrets with peep-holes and telescopes obscured by smoke. Finally, we must allow their full moral value to these prime requisites of accuracy and rapidity, since they alone may defeat a squadron before any of its ships are structurally injured, and may silence batteries before a single gun is dismounted. The other elements of battery power, penetration and explosive effect remain secondary to the accuracy, upon which all effects depend. Since no floating target was found impregnable to the five-inch breech-loaders, the smallest guns in our main batteries, we may not dispute the figures of our range-tables. The rumor which assigns overwhelming effects to the explosion of eight-inch shells relates chiefly to the production of flame and smoke. In closed spaces and among inflammable material these effects are appalling but hardly disproportionate. The perfect fuze is a thing of the future, since a shell may penetrate an iron ship from side to side, even carrying away the heel of an iron cathead without exploding, while a similar projectile may only blow out a shallow cup-like crater when striking antique masonry.

No pains taken in collecting stale rumors and inspecting sunken wrecks can give us the number of hits made or enable us to estimate the accuracy or explosive force of our projectiles. Admiral Montojo talked of seventy hits in the hull and superstructure of the Cristina. The latest inquest shows hardly half that number. If one had to guess at the percentage of hits to shots aimed at this unhappy flagship, five per cent. would be as neat a figure as any other. The best estimate of her loss was fifty-three killed and one hundred wounded. The numbers given by a Filipino oiler whose gossip seems gifted with recurrent vitality are obviously mythical; thus, he uses 365 too readily; he even introduced that suspicious figure when the official complement is doubled thereby. Admiral Montojo uses figures close to those of the Navy Register and gives an aggregate of 1875 men afloat, a number considerably in excess of the force under Admiral Dewey's command. In spite of occasional historic doubts it may be asserted that the Spanish total complement is meant to include the complement of officers designated for each ship.

During the hours devoted to refreshment, to counting ammunition and to consultation, the Spanish line was seen melting away; the Castilla in flames, the Reina Cristina blowing up as her magazines kindled, and the smaller vessels taking refuge behind the arsenal. Only the Don Juan de Ulloa kept her ensign flying and maintained her station close to the battery on Sangley Point. Two guns from this earthwork and two 24-cm. guns from the battery on the Luneta south of the bastions of Manila still roared ineffectually at intervals. Four or five miles north of Sangley Point engines were stopped and our cruisers gathered in irregular groups, which continued to draw the enemy's fire. Now and then a shell splashed within a few hundred feet of one ship or another, but these demonstrations had lost interest. When we first found ourselves in range of the batteries at the entrance only twelve hours before, every nerve was strained and every gun was ready to answer the enemy's fire. Now we could wait while our crews finished breakfast and cheered themselves hoarse when comrades passed within hail or the enemy's ships exploded.

Uncertainty as to the enemy's condition and anxiety about the supply of ammunition served to obscure the magnificent completeness of our victory. Blockade was the next step of belligerent action, and the question was raised whether that operation could not be more safely conducted from the port of Mariveles, at the entrance of the bay and twenty-five miles below Manila.

Fortunately, it was soon made plain that only a shattered remnant could oppose our absolute occupation of the whole bay, including the use of the resources of the arsenal and abundant opportunities for purchasing supplies from friendly natives. The gunboats still remaining might have annoyed us by torpedo attacks had not our work been completed and the moral results of conquest driven home by a triumphant demonstration in front of Manila. Therefore the commander-in-chief ordered the attack to be renewed at 10.30 and the column headed to the southward.

Lingering concern for the supply of ammunition imposed restrictions on the Olympia's five-inch battery and the Baltimore was designated to lead the advance. Approaching Sangley Point with a considerable lead she turned her broadside on the battery and sent her shells into the sand-pit, where their explosion opened vast craters and drove volcanic showers of gravel about the gunners. The Olympia followed, using her six-pounders effectively at 1800 yards range. As the Baltimore lay motionless the column was led past her, each ship firing when clear and cheering during the intervals. The Spaniards could not stand to their guns and were seen to run away, using an ambulance in their flight. They had, perhaps, fired half a dozen shots during the famous "second action." The Ulloa also had a gun's crew on board and fired two or three times. Then she was sunk by sheer weight of metal, by the concentrated fire of the Baltimore, Boston and Raleigh.

The Raleigh aimed a few shells at the arsenal. Several buildings were penetrated but none of them were shattered, and fires were kept under control. Still, a score of men were slain by fragments, and after an explosion had shattered the furniture in an upper room of the commandant's house, a white sheet was flown from the cupola of that building. A few minutes later the Spanish ensign fluttered down from the lofty sheers. The navy yard was captured, along with some 2000 prisoners, including soldiers of the garrison and sailors of the fleet who had fled from their crippled vessels. We were free to take possession or to destroy. At first destruction was preferred, and the Petrel was sent in behind the arsenal point to complete the work begun by the Spanish crews when they were driven out of their ships. They had opened valves and cut pipes to sink the vessels, but the water was shallow and the upper works remained accessible to the fires kindled by our boarding parties. In spite of both forms of destruction three of the enemy's cruisers, Isla de Cuba, Isla de Luzon and Don Juan de Austria, were rescued and sent to Hong Kong under their own steam, the hulls and engines being found reasonably sound and fit for repair. As we cannot suppose that Spanish officers welcomed the resurrection of their ships, we should not be surprised that they avoided interfering with those engaged in doing damage to property which they had tried to destroy and had been compelled to surrender.

In another part of the bay a similar task was in progress. The Concord was hurried in toward Las Piñas to burn the steamer Isla de Mindanao, which had been run aground after the naval action was over. This large mail steamer had prolonged the Spanish line to the eastward. She had been called a transport and disregarded while fighting was going on, although some witnesses asserted that she fired a few shots. It is certain that she had guns aboard, but other testimony goes to prove that her battery was not mounted or fit for use. Her presence in the line is accounted for by the fact that she could not enter Pasig River and that her master shirked the responsibility of taking her to sea when our approach was announced on April 30. She had been engaged in transporting war material and is said to have towed the Castilla back from Subig. She was advertised to sail for Barcelona on May 7. She was set on fire by persistent shelling and was totally consumed with her cargo. Her fate raised some problems relating to marine insurance but furnished no work for American prize courts. No other mercantile prize of appreciable value came to hand during the campaign in the Philippines.

The transport steamer Manila was, however, rescued by the Petrel and saved for naval use, along with half a dozen tugs and launches of moderate value but of convenient size for employment as packet-boats. Ten days after the action a Spanish gunboat steamed up to Cavite and fell into the clutches of the blockade. She had been sent to seek relief for the military and penal colony at Puerto Princesa in Palawan Island, which was entirely dependent upon the capital. The interruption of traffic had brought the garrison to the verge of starvation and the commander of the Callao felt bound to pursue his voyage even after noting the extinction of the lights off the entrance. He fancied that our squadron was firing a salute at 7.30 A. M. and then fell back on some theory of erratic target practice until a six-pound shot went through his awning. Then he surrendered and gave his parole. It was long believed that he was shot for this latter act—not for blundering into the bay without regard to rumors of war—but he was found to be at large when Manila was taken in August. A similar gunboat, the Leyte, came out of the Pampanga River in July, bringing about forty officers and a company of soldiers eager to escape from a district overrun by the insurrection. These voluntary prisoners were placed in the custody of the Tagalos whom they had sought to evade. They were afterward made prisoners on the same footing as the garrison of Manila, but other prisoners captured by American cruisers in Subig Bay were still held by native authorities up to April, 1899.

The business of the American fleet off Cavite was concluded during the afternoon and the ships moved up to a safe anchorage in front of Manila, where the batteries had at last fallen silent. The Governor-General had been warned by a message sent through the British Consulate that any further cannonade from these futile defenses would lead to the effective bombardment of the unprotected city which lay behind them. This stern warning, backed by a show of overwhelming force, made the authorities acknowledge their defeat and duly impressed the garrison. Not even a rifle-shot was fired at any vessel or boat of the Navy until August, although soundings and reconnoissances frequently led us within close range of batteries and pickets. Even when the fleet was actively engaged in forcing the surrender on August 13 the only vessel fired upon was the Callao, which had closed in to harass retreating columns of infantry. Yet the usual evasive reports were sent to the Spanish Government, announcing that we had not been fired upon since our ships "failed to come within range."

The most striking passage of the official reports sent to Madrid told how we "had been forced with heavy losses to change formations and to perform various evolutions." The single column was the only formation; recurrent broadsides the only evolution. The ground covered had been studied on the chart and probable lines of approach laid down before leaving Hong Kong. Nothing that the defense could do imposed any compulsion on our maneuvers. The plan as well as the guns was everywhere victorious.

French critics have ventured on a comparison of this action with the destruction of the Chinese squadron in the Min River in 1884. They point out that the French required only half an hour to accomplish the work which occupied the Americans more than two hours. But the operations cannot be thus compared. Admiral Courbet's ships took up selected positions within musket shot of the prospective enemy and waited until they were reinforced by an armored vessel and until the Chinese ships swung to the ebb tide and exposed their weakest points. Then the peace was broken and a tremendous fire of artillery assisted by torpedo-boats destroyed the Chinese squadron. Victory did not establish the French fleet in control of a safe inland anchorage commanding the enemy's capital; nor did it turn the defenses of the river entrance, which inflicted serious injury upon the French ships while withdrawing from their untenable position off the arsenal below Foochow. The fact that the French secured the advantage before the outbreak of hostilities removes this affair from the category of regular naval battles. Valuable lessons in ordnance were taught, but the tactical example is inadequate for comparison.

The battle of Lissa in 1886 has a more direct bearing on the case. The Austrian fleet found the Italian deployed for bombardment and unprepared for mutual support. Several fine ships were destroyed by ramming and by shells, but a large portion of the Italian division engaged was allowed to escape and a still more helpless squadron containing a number of sailing frigates was not even reconnoitered. The ram gained by this action a degree of credit which it has utterly failed to maintain, and the excessive development of bow fire and other defective tactical dispositions were thereby inaugurated.

The curious lack of persistence shown by the victor at Lissa also characterizes the most recent fleet action in the open sea—the battle off the Yalu in 1894. The Japanese admiral fought his ships wisely and won a brilliant victory over the inanimate squadron of the Chinese. His tactics demonstrate the value of extended order and of flexible formation in column as well as the capacity of cruisers and gunboats to fight in line of battle when rapid-fire and constant movement are the order of the day. These facts were the basis of Admiral Dewey's tactics in Manila Bay and they enabled him to finish his day's work with a complete and crowning success, while the Japanese squadron hauled off and left a defeated remnant reduced to the last round of ammunition to escape into a fortified harbor whence months of toil were required to extricate them. Possibly the Japanese were also short of ammunition, or anxious and uncertain about its endurance.

Of Nelson's masterpieces the battles of the Nile and Copenhagen offer certain analogies to that in Manila Bay. Pilotage was a prime factor of tactics on both occasions and shore batteries planted to support the defense also had their influence. The advantages of steam and of high-powered guns have greatly transformed details and distances, but tactical principles endure. Nelson always sought to overmatch his antagonist by isolating detachments, and never meant his captains to engage as duellists irrespective of plans. At Manila it was the enemy's blundering disposition which annulled any effective combination of his abundant resources, but the glorious fact that our column fought as a fleet under the exact control of confident leadership gives this action a place among the sea-fights of history.

It may seem a paradox to many, but the first honor of this record was due to unflinching readiness to act in ignorance—ignorance of the enemy's batteries, of his mine fields, of the stations and even of the numbers of his fighting ships. All these things might have been ascertained at the cost of much time and coal, but the painful effort would have lowered the vitality of the fleet and weakened the moral power of our Government at home and abroad. Because these things were realized on board the Olympia, and because of a certain natural contempt and cheerful distrust of all Spanish military and industrial undertakings, Admiral Dewey led his squadron through guarded channels at midnight and arrayed them for battle at dawn.

The supreme trial of a naval commander comes when his consorts are crippled or sinking in the midst of battle, when his splintered decks are ablaze, and blood runs from the scuppers. Since this fate was not met and vanquished we may not claim the highest rank for this memorable contest. But surely there are many who must hold it a matter of pride that our ships escaped and our men's lives were spared. This fortunate immunity was not the result of fine-spun calculations. The battle was fought to win, with no purpose of shunning close encounter. The escape of 1700 American seamen during a struggle in which a shell for every man afloat was aimed at their ships still presents a problem incapable of mathematical or mechanical solution. It must simply go on record as an amazing experience.

Spanish commentaries ascribe the control of the victorious ships to men protected by thick armor and "in impenetrable calm directing engines of death with instruments of precision." Of course, this notion involves all sorts of absurdities. Except the sight-bars of the guns, the compass was the only instrument used in the flagship, and that stood on a lofty perch over the forward turret, on a grating just wide enough for the Admiral and the observer engaged in taking bearings. This was an open air battle where the ship was conned by visible landmarks and the distances roughly measured by the simplest methods. Every ship was under the eye of the leader, and none detached themselves for those single-ship combats which have claimed too large a place in popular legend and even in professional ideals since the naval war of 1812. Each ship did her best with all the guns granted her by the Bureau of Ordnance; straight shooting was the only exploit worth mentioning, and no recording angel will ever rightly apportion the ragged scores of our gunners.

The immediate strategic results of this action were slowly grasped. It soon became apparent that ships could cruise or anchor where they pleased without regard to the remaining armaments of the enemy. The batteries at the entrance were cut off from support and might have been attacked in detail. Therefore they were promptly surrendered. The navy yard was also surrendered on May 2, the garrison of Cavite and the naval battalion formed from the ships' companies being allowed to march out with their arms and other portable property. They had the presumption to ask for safe conduct to Manila, although many of them were held in garrison at points which threatened our occupation of the Cavite peninsula through intrigues with the natives, if not through aggressive movements. The wounded and sick at the naval hospital at Cañacao, numbering some three hundred, were sent to Manila under flag of truce. The inconvenience of guarding prisoners on shore and of supplying them with provisions may account for this policy of release as well as for the subsequent plan of leaving prisoners in the custody of Filipino authorities.

A small marine guard was detailed to guard the navy yard a day or so after the Spaniards withdrew. Working parties were sent ashore to disable the guns at Sangley Point, which was easily effected by exploding a ring of gun-cotton disks around the chase of each gun. The magazine was incidentally blown up during the operation. Much small-arm ammunition was dumped into the bay at Cavite, whence the Filipinos afterward recovered it and refilled the cartridges. Some of the smaller rapid-fire guns were recovered from the wrecks and the Manila and Callao were destined to bristle with an eccentric armament. Some of the larger guns were also recovered from the ships, but breech-blocks were lacking and rust and fire were allowed to do their work on the main batteries. The Filipinos were allowed to gather some weapons from the arsenal; perhaps a hundred serviceable rifles, a trivial pair of bronze howitzers and two or three old smooth-bore guns were the only important items—all abandoned by the Spaniards as not worth carrying away.

The public was induced to form a very low estimate of the vitality of the fleet and gloomy prophecies were spoken of " crippled ships in an enemy's harbor." Of course, the fact is that a fleet can stand anything but defeat, and that an enemy's harbor is quite as good as any other if the enemy's fleet is destroyed and his batteries silenced. Manila Bay has its disadvantages as a harbor and the Cavite arsenal is only a fourth-rate navy yard, but all the shelter and all the resources provided by nature and by the Spanish Government were available. There was no dry-dock, but there was a marine railway and fair range of machine shops and well-filled storehouses. The Navy Department hurried out liberal supplies in all departments and all reasonable repairs could have been effected in due season. Fortunately, no delays or repairs were required to maintain the fleet in a state of constant efficiency.

The presence of such a force reduced Spanish authority in the capital to a mere pretense and parade of dominion. The walled city could have been laid in ruins by a few hours' bombardment, the foolish batteries having demonstrated their incapacity to hinder. Admiral Dewey summarized the situation on May 7 by cabling to the Department that he could take Manila any day, but that 4000 infantry would be required to police such a city. The assertion may be ventured that no subsequent occurrence has impaired the soundness of this modest calculation. There were moral and political factors which rendered the Spanish position untenable. At first it was thought that an inland position out of range of naval artillery might be fortified and garrisoned and the water-front abandoned to American attack. Secure occupation would have been impracticable had the Spanish garrison been able to follow this plan, but the smouldering fires of the great Filipino insurrection of 1896 interposed a fatal obstacle. Withdrawal from the city left the insurgents in possession and the country was ready to cut off supplies from the exterior.

The insurrection was not long in putting itself in motion. Random majors and captains hurried on board at all hours of the night to ask our intentions, to beg for supplies and to offer assistance. At first it seemed impossible to take these emissaries seriously; their notions lacked coherence; they could neither count their partisans nor their enemies. The villages nearest Cavite had formed guards for local protection and seemed incapable of organized or intelligent effort. The town of Cavite was ruthlessly pillaged by canoe-loads of natives from the towns of Bacoor, Imus and Cavite Viejo—towns which had seen rebellion suppressed in fire and blood during the preceding year. Natives chalked "Tagalog" on their doors and shut themselves up to escape the storm, while Spaniards fled to Manila, abandoning their homes to pillage. One Chinese millionaire hired a Filipino guard and saved his warehouse from plunder. He may have been spared because of the fate of his son, who was one of the first victims—because he was one of the wealthiest men in Cavite—when the Spanish fury of 1896 ran its course in that unhappy town. Three stragglers from English merchantmen lived at free quarters and pillaged houses and churches until the Filipinos found a leader and set up a revolutionary government.

The new era began when Emilio Aguinaldo landed from the McCulloch, which had brought him over from Hong Kong on May 19. Pillage ceased in Cavite and San Roque and a new crop of robust recruits, Tagalos from Cavite and Batangas provinces, were soon organized into ragged regiments and supplied with arms as fast as they came to hand. The small number of rifles left in the arsenal was only sufficient for guarding the peninsula of Cavite. For an advance toward Manila a larger force had to be equipped. Some thousands of rifles were purchased by the fund contributed by the Spanish Government to induce the

Filipino leaders to go to Hong Kong in January, 1898. A third source of supply was drawn upon before the month was over. Some thousands of Spanish prisoners were brought into Cavite, their arms going to swell the power of the insurrection. Many officers of the army and navy who were included in the capitulation of May 1 were among these captives. The helplessness of scattered detachments in a densely populated and hostile territory was demonstrated by these captains. The natives moved independently of roads, relying upon supplies of local production and ammunition and rifles taken from the enemy.

In none of these operations did the American forces bear a part, not even in checking the relief columns which marched out of Manila by the single road skirting the shores of the bay and exposing troops in advance or retreat to the fire of naval artillery. The progress of the insurgents was visible from our anchorage, and early in June their lines were drawn to invest Manila from the north as well as from the south. The force which captured the large city of Malabon and occupied Caloocan was led by rebels who had not allowed themselves to be included in the capitulation made when Aguinaldo went to Hong Kong. The northern leaders had maintained an active or latent rebellion during the months preceding the arrival of the American fleet, but they promptly joined the revolutionary organization and accepted Aguinaldo as dictator in May and as president in July, according to his successive proclamations.

Meanwhile, the fleet engaged in the maritime blockade of Manila Bay. Since diplomatic notification was impracticable, each vessel had to be visited for direct notification. The blockade was not of great military advantage except as it kept the garrison on short rations. The soldiers seem to have had plenty of rice to the end, but the supply of beef was soon exhausted. The blockade by land was felt more severely than the maritime investment, especially as the latter was often mitigated on grounds of humanity or to afford relief to non-combatants and foreigners. Thus the mails were regularly delivered when brought from Hong Kong by mail steamers or men-of-war. Invalids and neutrals, including hundreds of Chinese, were also allowed to take passage to China.

The legal principles affecting blockade were carefully studied and no stranger found any reasonable ground for complaining of the methods of enforcing that undeniable belligerent right. Several vessels entered Manila Bay with cargoes of coal purchased by agents of the United States in Australia or the Far East. The legal status of these vessels and cargoes was clear and secured them from interference by cruisers of their own nation. As for danger from the other belligerent, there had been nothing to fear since May 1, when the Spanish fleet was destroyed. Neutral vessels in port before our coming were allowed every indulgence in completing their outfit for sailing. Those which carried coal were discharged for the benefit of the fleet. Some captains failed to understand the right of our government to make compulsory purchases, but were soon convinced by the text of the treaties which authorize this method of dealing with contraband of war in ports under military occupation. The treaty with Great Britain is extremely clear and rational upon this important point.

Much confusion in regard to the supply of coal to belligerents will be removed by reference to the rule announced by the British Government early in May: " No coal shall be supplied to any belligerent ship except for the specific purpose of enabling them to proceed to their own country or to some other named neutral destination with reference to which this supply of coal is given." The second clause is even more novel in its clear and direct terms: " Coal should not be supplied at all if there are reasonable grounds for supposing that it is in fact to be used for another purpose." This rule was bound to be fatal to Spanish attempts to send reinforcements to the Philippines.

In another particular the British Admiralty Instructions have an advantage over our manuals of international law and regulations. The recognition of the actual possession by insurgents of towns, forts and ships is specifically provided for. Even the display of an insurgent flag on the high seas seems to be allowed, whether belligerent rights have been granted or not. The fact that the Filipinos were insurgents against our enemy did not seem to deprive them of any right granted by Great Britain in her character as a neutral, and their flag was shown by several cruisers entering or clearing from Cavite during the summer. The Spanish newspapers made appeal to all the naval representatives of neutral powers to arrest these cruisers or pirates, but no action was taken, although one sea-going steamer, the Compania de Filipinas, which was carried over to the insurrection by mutiny led by a Cuban belonging to the ship's company, seems to have been warned by a German cruiser that her flag could not be recognized and she could not be allowed to take part in military operations.

In immediate response to this warning the Raleigh and Concord were sent to Subig Bay, where they effected the capture of Isla Grande and turned the place over to the Filipinos, along with the troops and naval officers composing the garrison. This was the nearest approach to a direct alliance during the campaign. Most of the incidents relating to the "Tagalo-Yankee alliance" denounced by Spanish journalists were pure fabrications. In counting the slain in battle about the first of June they announced the finding of many wearers of the naval uniform of the United States. Of course this mention served to introduce other falsehoods. Aguinaldo was said to have been placed in irons on board an American man-of-war as a punishment for his failure to complete the conquest of Cavite province.

As a matter of fact, the rapid progress of insurrection was the chief ground of anxiety during the month of June. Manila was invested; the water-works were occupied; the capture of the city was confidently predicted. Aguinaldo seems to have been bound by no promises except to carry on the struggle with due regard to humanity and the laws of war. That was all that could be demanded unless mutual obligations were contracted—unless the Americans were ready to make promises to the Filipinos through their leaders. All such contracts were scrupulously avoided during the period of naval control.

The real grounds for dreading the complete success of the insurgents related to doubts concerning the ability of the leaders to control the wilder elements among their troops—the savages from the hills and the rabble of Manila. All revenges and atrocities would have been charged to the "unholy alliance" by the Spaniards and would, perhaps, have furnished motives for intrusion or intervention by some of the foreign powers represented in the bay. About the middle of June the relief crews for one squadron were brought to Manila by a chartered mail-steamer, and one power had, therefore, at least 1000 men available for landing parties. It is credibly reported that attempts were made to induce the consuls and senior naval officers to unite in arrangements for the joint occupation of the commercial quarter of Manila for the protection of the life and property of foreigners. All propositions looking toward interference with our manifest belligerent rights were bound to fail upon encountering the sturdy common-sense and straightforward diplomacy of Sir Edward Chichester, commanding H. B. M. S. Immortalité, and of the British Consul, Mr. Rawson-Walker, who, like his colleague at Santiago de Cuba, lost his life during the strain imposed by the Spanish-American war.

The English authorities represented the larger portion of the foreign section of the commercial community in the Philippines and had, therefore, a dominant influence in international councils. The German colony also claimed considerable numbers and wealth. It is said that many Swiss subjects were enrolled in the books of the German consulate for protection. It is only fair to say that the Filipinos are admitted to have been careful and successful in guarding the property of foreigners from pillage during the whole period of disturbances up to the end of 1898. Spanish property, especially that of corporations, commercial or religious, has been ruthlessly confiscated, and taxation on a severe scale has been carried out on the basis of the system established by Spain.

The international complications were more puzzling than serious, perhaps, since most of them seemed to arise from trivial instances of ignorance or inaptitude in carrying on the naval routine imposed by the situation. If so, they were sufficiently and impressively rebuked. Sympathy, probably, had little to do with the matter, but there may have been a certain tendency to aimless and tactless intrigues. Certain proprieties of the situation are so far from being obvious that some random criticism was put in circulation: thus it proved to be right for neutral vessels to salute the Spanish flag on anchoring off Manila, and to dress ship on the frequent holidays announced in honor of Spanish royalty.

It was plain that many problems would be solved by the occupation of the enemy's capital, and the arrival of the necessary troops was eagerly yet patiently awaited throughout the month of June. It is worthy of note that an excellent regiment, the First Infantry, U. S. Army, had been sent from San Francisco to Florida during the week which saw the Asiatic squadron starting for Manila. Had the prospect of an instant and complete naval victory been realized and its political and popular significance been weighed, this transfer might not have been ordered. The first expedition, commanded by Brigadier-General Anderson, comprised about 2500 men—a force quite inadequate for the investment or assault of Manila and even insufficient for police and garrison duty. This force was therefore placed in the barracks available at the arsenal and town of Cavite.

Reconnoissance was begun by boats at an early date and it was found that the water in front of Manila was deeper than appeared by the chart, and that an extended line could cruise off the waterfront within the effective bombarding range of 4000 yards from the principal batteries, with the walled city as a background or a target for our shells. When the time for this bombardment seemed at hand the Commander-in-Chief approved a plan for placing buoys to mark the turning points and to indicate the distances while running past the town. Of course the buoys were not to be placed until the attack was imminent, and events finally seemed to render this device unnecessary.

Reconnoissances were made by officers of the army early in July, and naval examinations were also made to identify landmarks for directing the fire of ships to enfilade the Spanish trenches, and also to investigate the conditions affecting the landing of troops and supplies at various points. At Malabon, five miles north of Manila, and at Parañaque, about the same distance to the south, there were navigable rivers with entrances obstructed by bars over which less than a fathom could be carried. To the northward shoal water extended off shore more than two miles, and the roads led inland from the islands where the towns stand toward Manila. The surf was heavy, also, everywhere except to leeward of Cavite peninsula, during the southwest monsoon, which blows from June to October and freshens every afternoon. There was an advantage to the army in having a flank covered by cruisers and gunboats whose guns could be directed to rake the Spanish trenches and to protect the advance through the suburb of Malate. Therefore the southern approach was selected, and before the end of July the Filipinos were induced to abandon the sector next the beach to allow our troops to occupy and improve their trenches. The covering cruisers moved so close to the eastern shore that the Spaniards thought them aground, but found that none of their heavy guns could be trained to reach their anchorage. Naval boats and their crews, directed by able officers, were, as usual, of great service in expediting the landing of men and stores. The native lighters, or *cascos*, were found well suited for this work when there was not much surf. Landing at the beach at Tambo saved our troops a costly circuit of some fifteen miles over miserable roads by way of Noveleta and Bacoor.

Upon going into camp our soldiers found themselves exposed to heavy rain, with very inadequate shelter tents for protection from the weather. They bore the experience manfully, worked hard in the trenches, improved in spirits and discipline, and even maintained better health than when on garrison duty in Cavite. These valuable results may be held to compensate for the trials to which they were exposed during this season of formal military operations, conducted with reference to other than concrete and visible results.

The Spaniards still held the trenches in a characteristically inert fashion. They allowed our men to step out in front of the Filipino trenches and to throw up a new line of parallel intrenchments a few rods in advance. This work was done by daylight and whole battalions were employed in making the new parapets. As the section was within easy rifle range, the defense can hardly be said to have taken their *rôle* seriously. Yet they could still waste ammunition on occasion, and on the night of July 31 they opened a heavy fire, as they had been accustomed to do for many weeks during the insurgent occupation of the same sector. The object of this volley-firing, which was often supported by artillery from the trenches or from the antique stone battery of San Antonio Abad, was not apparent. The lofty hedges of bamboo overhead were much cut up at ten or fifteen feet from the ground, but the trenches offered plenty of cover and the danger space was far in rear of the line. Unfortunately, the regiment holding the trench stood up and fired with great rapidity, reducing their burden of heavy Springfield ammunition to the verge of safety. Fresh troops were hurried up in support, and they suffered losses in advancing through the danger space. The notion that the Spaniards had sallied forth from their trenches prevailed during that night and has been given a place in many journalistic narratives. The reports of responsible officers should eliminate this notion from history. The affair cost our troops a loss of twelve killed and forty-odd wounded. The Spaniards resumed volley practice on other evenings, but their efforts were disregarded and our troops escaped with very few losses.

Urgent requests were made to have the fleet silence the stone fort on San Antonio, which stood on the beach within effective range from deep water. This structure had been proposed as a target on the afternoon of May 1, but it was spared as bearing no relation to naval attack. Its prolonged immunity was due to a wish to avoid a general engagement until arrangements for immediate military occupation were completed. The destructive bombardment of an inflammable city crowded with women and children was a task which it was patiently hoped to avert. It was held equally desirable to guard the city from any risk of pillage and, as far as possible, to prevent its occupation by the Filipinos, who were reckoned as tractable but uncertain allies.

Another restraint was removed late in July, when the important news of the return of Admiral Camara's fleet to Spain after passing through the Suez canal was tardily received. From the first the prospects of this expedition had been discussed in the fleet. Up to July 1 few had any faith in the reality of the project of making this diversion. It seemed a false move to uncover the coast of Spain; it seemed an impracticable move to get a squadron containing a crippled battleship, weak torpedo-boat destroyers and overladen transports across the Indian Ocean and the China Sea while they were unable to make use of coaling stations. We know now what Admiral Cervera knew a year ago, that this squadron was quite unfit to cross the Atlantic. But the fact that Admiral Camara had actually entered the canal imposed the necessity of considering plans to meet his advent.

We are assured that the troops which had arrived from the United States were prepared to maintain themselves in an inland position during the absence of our fleet. This disposition implied a certain confidence in the native alliance. It also left the naval Commander-in-Chief free to remove all his ships from Manila Bay in order to make the best arrangements for guarding the transports and colliers. Assuming that the Spanish fleet was really superior to ours in fighting force, the anchorage off Cavite was hardly the place to meet it. The tactical methods of Admiral Montojo had not commended themselves in practice. The next step considered was that of sending the transports and colliers to take refuge in Subig Bay and disposing the men-of-war to guard the entrance to that port and to threaten any fleet bound for Manila. Few officers in the fleet commanded by Admiral Dewey had any doubt then of our ability to beat off the Pelayo, Carlos V and their consorts at the end of a long voyage. Doubtless none would question the result now, especially taking into account the arrival of the Charleston as a reinforcement to the six cruisers which fought the battle of May 1.

Probably the plan of standing off to the eastward with all the elements of the fleet, in the hope of meeting the monitors somewhere in the Pacific Ocean, was also considered. A high military authority goes so far as to say that this plan of temporary withdrawal was adopted under the pressure of alarmist calculations imported with the second military expedition. This measure would have caused much concern in the United States and could hardly have improved the spirits of the fleet. Fortunately, no such expedient was ever inaugurated. Camara had turned back before the calculations were produced.

These hypothetical situations involve the discussion of the value of monitors like the Monadnock and Monterey in naval engagements and in bombardments. When the Monterey came in on August 4 the comments made on her stability as a gun platform in the ordinary swell of the southwest monsoon were far from encouraging. If the Spanish Admiral chose to fight in the open sea during the regular monsoon or within a week after the passage of a typhoon, or even if the meeting took place in Manila Bay on a summer afternoon, the Monterey's battery could hardly have been a decisive factor. The oscillations due to excess of stability would compel her to throw away her shots under such conditions. The Pelayo might have been put out of action by the same process which proved fatal to the armored cruisers at Santiago: by setting fire to her woodwork, by killing her guns' crews, by the general dismantling and demoralizing effect of rapid-fire guns, mounted to afford a clear vision and close aim, delivering an incessant storm of explosive projectiles.

If the Monterey and Monadnock were of uncertain value in a fleet action, their cruising efficiency must be rated still lower. Neither the tactical nor strategical qualities of monitors would justify a future plan of campaign which sacrificed time, moral effect and concrete results to secure such problematic reinforcements. It may be claimed that the heaviest artillery has supreme importance in bombardment and in silencing shore batteries. Against towns any shells that can be exploded among compact masses of stores, shops and dwellings will serve the main purpose, although destruction may be made more appalling by using heavy bursting-charges. Against modern earth-works destructive effects cannot be attained by using any artillery which fires slowly or is uncertain in hitting. Craters in sandbanks do not cause structural injury to batteries. These can be disabled only by direct hits, upsetting guns or shattering mounts. Of course, the slaughter of guns' crews may also impose silence, but no weapon is better adapted for such work than those of the secondary batteries, when the objective is within range of open water.

Until all concern regarding Camara's movements came to an end it was resolved to keep the American fleet intact and to decline any movement which might bring on a general engagement. A few days more were consumed in waiting for the monitors, the first of them, the Monterey, arriving on August 4. Finally, on August 7, the naval and military commanders-in-chief united in summoning the captain-general to surrender. Twenty-four hours were allowed for the removal of non-combatants, and this time was extended for another day while correspondence was in progress. The Governor-General asked for time to communicate with Madrid via Hong Kong. Return dispatches might have been expected in about a week. He complained that there was no place outside the city to which women and children, along with the sick and wounded, might retire, since the insurgents held all the adjacent districts. Minute directions were published assigning non-combatants to the casemates for shelter during bombardment. They were advised, however, to seek safety at military posts in the outlying suburbs. Certainly, confinement to the foul dungeons under the old walls would have been fatal to many.

Fortunately for the unarmed population, no one in authority meant to expose them to bombardment. The American commanders urged surrender for the sake of humanity; the new Governor-General—General Augustin having been relieved by General Jaudenes on August 4, because of a message to Madrid pointing out the necessity of prompt surrender—admitted the force of their appeal, but declared that the council which he had called opposed capitulation. This was his official ultimatum, followed by an informal intimation that the honor of Spain, of the army and of the captain-general would be satisfied by a simulated conflict. Since there had to be a bombardment, the fleet might shell the stone fort of San Antonio Abad, and our troops might open fire on the adjacent trenches. The town batteries would keep silence in order to avoid drawing our fire, and the troops would retire from the outer defenses as soon as they had been briskly assailed. Subject to a warning that fire from any battery would be effectively returned, this message seems to have been made the basis of a mutual understanding.

The morning of August 9 had been selected for beginning the attack, but it was found that the army needed time to reconnoiter the approaches to Malate and to land more men and stores at Camp Dewey, on the beach north of Parañaque. The state of the tides had also to be considered with reference to fording the creek close to San Antonio Abad. These requirements delayed aggressive movements until Saturday, August 13. It was felt that this delay might entangle us with peace negotiations, which would leave our troops in an embarrassing situation unless a valid capture was effected before documents were signed. As it turned out, the capture was a day late, a suspension of hostilities having been announced on August 12. The possession of the bay and city of Manila was, however, covered by stipulation, and for the rest Spain was unable to offer any effective protest.

It may be assumed that all general officers on both sides were duly informed as to the nature of the demonstration which began at 9.30 A. M. on Saturday. Excellent maps had been obtained from Aguinaldo's headquarters, and they had been supplemented from other sources and by reconnoissances. The fleet could be held in check by signals, but the task of brigade-commanders, regulating the advance of troops through thickets and rice fields, was somewhat harder, complicated as it was by an effort to intercept the advance of the Filipinos from the posts which they held close to the Spanish trenches in the northeasterly prolongation of our line. The effort to comply with the request of the Spanish captain-general that our lines might be extended to the Pasig River left gaps by which the insurgents entered the city, and introduced some confusion into the progress of our own forces.

The advance of our right wing along the beach was covered by the guns of the ships, which were also able to batter the stone walls of Fort San Antonio and to rake the trenches beyond. Some persons seem to have fancied that the fleet had no other function in this attack, but those who had heard the guns of May 1 knew better. With the Olympia, bearing the Admiral's flag, within 3000 yards of the principal batteries and well inside the three-fathoms curve, with the Baltimore, Charleston and Boston close to the end of the breakwater, the Raleigh and Petrel covering Fort San Antonio, and Concord closing in toward the mouth of the Pasig in readiness to take Fort Santiago, the situation was hopeless to all intelligent observers from the walls and towers of Manila. Spanish accounts insist upon the dominating power of the fleet led by Admiral Dewey. We may not borrow their terms of comparison, but we may remind ourselves of the facts.

The actual operations of the day began by brisk firing from the Olympia, Raleigh and Petrel at the fort of San Antonio, which lay silent and almost deserted outside the Malate suburb. As we steamed to the eastward the morning light was deceptive, the smoke hung heavy in our path, and the landmarks were shut in by baffling showers of rain. As the fall of the shot could not be noted for correcting the ranges, the firing was wild for the first ten minutes. For the rest of the hour, although we lay in white clouds made by charges of brown powder and red clouds made by smokeless powder, it was fairly accurate, many shells grazing the parapets to rake the trenches further inland, others exploding against the masonry of the fort, and one, at least, penetrating the wall and scattering splinters of stone and small-arm ammunition about the interior of the works. The slight impression made by shells which failed to explode or which burst without penetration was rather disappointing, but it soon became evident that our fire was thoroughly effective.

An officer long since honorably distinguished as a military critic and historian assures the public that the firing practice of the fleet was inferior to the performance of their batteries on May 1. Percentages are not available for the discussion of this problem, but it is plain that the desired result was accomplished on both occasions. The enemy was driven out of the batteries and trenches quite as soon as their occupation could be attempted. Yet only three ships fired, while five were held in reserve. Nor did the Olympia and her consorts use their secondary batteries, although within effective range. Every precaution was taken to keep the guns under strict control and to cease firing when the army signalled its readiness to go forward.

Under these circumstances it is hardly profitable to thrash out comparisons of naval marksmanship with that of the field batteries on shore. One excellent volunteer battery had its guns well advanced some weeks before the attack and fired at a familiar target over a measured range about one-third as long as those estimated from the ships. No doubt their guns made a fair percentage of hits and produced as much effect as their weight of metal would allow—as much as they had ever produced during previous artillery duels. But the gunboat Callao, which skirted the beach and drove the enemy through Malate as our troops advanced, was capable of doing the work of more than one battery of field artillery moved by hand. Scarred as she was by rifle bullets, they could not reach her motive power or the spirit which held her on her course along the enemy's flank.

Another error was given circulation in a reporter's version of an interview with an officer of rank while on his way to Paris in September. The printed report contains these remarks with reference to the affair of August 13: "The Admiral did not wish to risk his ships and kept a good distance off. He made excellent practice all the same; but at that time he had nowhere to send to get repairs." As previously noted, Admiral Dewey had ships drawing twenty-four feet cruising within the three-fathom curve and within effective range of the heaviest Spanish batteries. There was too much confidence in the power of the fleet to admit the sort of caution here suggested. The story belongs with the tale of English gunners hired in Hong Kong—with the fiction of a consular pilot at the entrance of Manila Bay.

The advance of the troops in column along the beach was a fine sight, but when our men were seen fording the stream near Fort San Antonio every one was glad that the Spanish troops had quitted their trenches beforehand. Otherwise the experience of the naval landing-party at Fort Fisher might have been repeated under these walls. Finally our troops began to mass themselves in the open space of the Luneta promenade, close to the moat of the walled city. The signal of surrender was at last shown, according to agreement, and officers of the military and naval staffs landed to draw up the terms of a preliminary capitulation. They were soon followed by Major-General Merritt, who ratified the terms of surrender, which were made as liberal as possible, and took measures to restore order in the city and its suburbs.

The Second Oregon Regiment had been held in a light-draught transport and they were promptly landed on the quays commanding the river and placed on guard within the walled city. Though they had not been under fire, they were as readily available for this important service as their comrades who had marched in through the mud, losing half a dozen killed and the usual proportion wounded in accidental encounters with the retreating Spanish infantry. Of course, the Spaniards had also suffered losses; soldiers had fallen for the sake of military honor—not with any purpose of prolonging the defense. Such dramas of advance and retreat need more careful rehearsal if useless sacrifices on both sides are to be avoided.

The Spanish flag continued to wave from Fort Santiago until the capitulation was signed. Then it was hauled down by two signalmen from the Olympia directed by Lieutenant Brumby, Admiral Dewey's flag lieutenant and his representative in drawing up the terms of surrender. It was fitting that this officer should perform a service of such distinction, and no narrative of the campaign of Manila Bay would be complete unless it laid stress on the conduct and abilities which earned him this high honor. A company of Oregon volunteers with the band of their regiment came up in time to render due honors to the huge flag sent ashore from the Olympia.

While the capitulation was in progress the gunboats Cebu and Bulusan, along with steam-launches and other boats, were wantonly sunk or burned under the eyes of the Spanish naval officers. These incidents revived some distrust of the loyalty and discipline of the garrison, and Admiral Dewey directed the breech-plugs to be removed from all the modern guns along the western face of the fortifications. This task was performed on the morning of August 15, the working party meeting with no objection or inquiry on the part of any one in authority, though squads of Spanish artillery-men were still quartered in the well-filled magazines of the two 24-centimeter guns outside the moat. In all, twelve guns were dismantled and their breech-blocks were stowed on board the Olympia. The era of proclamations and negotiations relating to the insurrection now began, and the Filipino leaders were induced to withdraw their troops from the city a few weeks after its capture from the Spanish.

No maritime prizes were taken at Manila, although a dozen sea-going steamers belonging to Spanish owners lay in the river along with many tugs and sailing vessels. Several steamers had been allowed to anchor in the bay to accommodate foreign refugees under foreign flags. This arrangement was a matter of agreement between the consuls and the American naval Commander-in-Chief. The legal status of these vessels was in no wise affected thereby, but it was decided at Washington that no lawful prizes could be taken in joint operations of the army and navy. So the Spanish owners resumed possession of their ships and were allowed to cruise with them under the American flag, some citizens of the United States being found to lend their names for that curious and informal transfer by which a bill of sale acknowledged before a consul is made to serve as an American register for ships which may not enter American ports. The same expedient was adopted on a large scale in 1884, when the fleet of the China Merchant's Navigation was placed under the American flag to avoid capture by the French. This device would hardly survive investigation by a critical belligerent. In this case the intention seems to have been to avoid seizure or detention by Filipino local administrators. In this the Spanish owners were for a time fairly successful, though protests and interferences occurred both from Spanish and native authorities.

The rest of Luzon and important stations on the other islands were surrendered to the insurgents within a month after the capture of Manila. Had the leaders been well advised, or had their troops been under such discipline that they could be safely disbanded without relapsing into brigandage, or could they have been withdrawn from the suburbs of Manila, where many of them had their homes, subsequent collisions and irritations might have been avoided. Besides this blunder of Aguinaldo's, other indications of trouble darkened the horizon.

An able American correspondent who came out in July was allowed to send cablegrams to the *London Times*, dated at Headquarters, Cavite, July 29, which may be taken as significant if not inspired. Adopting inaccurate rumors of lavish distribution of arms and ammunition from the Cavite arsenal for the free use of the insurgents, and denouncing the early relations of American authorities with the native leaders as gross mistakes, this newly-arrived and imperfectly-informed critic declares that "revenge and plunder" are the only incentives which lead the Filipinos to continue the conflict. These opinions are in plain contradiction to those previously expressed by responsible representatives of American authority. They serve, however, to introduce the opinion that "the only means of controlling Aguinaldo's rabble is to disarm the whole population." Six months later, after the army of occupation had been doubled in force, this difficult and costly undertaking was inaugurated, with results which history will enumerate and appraise.

The published narratives of this campaign, and especially those of the battle of May 1, demand some measure of attention. These reports vary in value according to the actual opportunities of the observer, his capacity for understanding what he saw, and his caution in avoiding romantic illusions and restraining the natural desire to exalt the achievements of his particular ship. Of the journalists, more or less present as spectators, Mr. Stickney had the advantage of technical knowledge and a position on the bridge of the Olympia. Reports cabled by passengers in the McCulloch were of more value in their original form than in that given them in the offices of newspapers addicted to the literary vice of expansion even before they learned to advocate the national policy which bears that name.

Of a certain eager "eye-witness" who was first in the field as a lecturer it is sufficient to remark that in publishing a list of officers and men who were on the forward bridge of the flagship he displays total ignorance of the customs of the service, of the necessities of navigation and of the official report of the Commander-in-Chief. Moreover, the editorial department of a leading magazine accepted his communication without checking it by that important document. After that it hardly seems worth while to attempt the correction of this chronicler's facts, although it may be allowed that his record of personal impressions is not destitute of interest.

Of the narratives enshrined in well-bound volumes it is sufficient to say that few of them have escaped the taint of "expanded" cablegrams, or of that curious mixture of rumor and fabrication labeled "With Dewey at Manila," compiled by

Thomas J. Vivian. This begins like a second-hand version of an authentic letter, but closes in scenes of melodramatic confusion. Mr. John R. Spears finds his surplus torpedo-boats there, and Hon. Henry Cabot Lodge borrows a series of duels and explosions from this unhistoric reporter. Maclay's "History of the Navy" was an early gleaner in the field of imagination, bestowing the Spanish fleet behind a breakwater of stone and timber only represented in reality by a few stray iron lighters, some of which were laden with sand to cover the water-line of the Castilla.

Many of these distortions of history are due to wanton impulses toward sensationalism. Spanish narratives suffer from the same defects, and those printed in Manila were warped by the restraint imposed by the Governor-General's decrees of warning. Among the minor offenses classed as high treason was that of "publishing any statement which might tend to discourage the defenders of the country." For this crime a summary court-martial had its choice of penalties between death and imprisonment in chains for life. Yet the daily journals of Manila were able to resume publication on May 4 and to give a fairly intelligible account of the events enacted under the walls of their city. Even the trimmed cablegrams of the captain-general were sufficient to reveal to the journals and public of Madrid the tragedy of Spanish defeat, and riots broke out in a score of Spanish cities—crude revolts against incompetence which had brought about national humiliation and social misery.

Many curious details concerning the defenses of Manila and the complex methods of Spanish naval administration were accessible among reports filed in the office of the commandant of the arsenal at Cavite and in the mansion in Manila occupied by the admiral commanding the station and squadron of the Philippines. These papers show that much zeal was manifested in improvising armaments during the month of April, but that supplies and methods were alike defective. Even information seems to have been scanty, since Admiral Montojo claims to have gone to Subig in ignorance of its actual defensive condition and to have been surprised and disgusted at the deficiencies and delays which induced him to bring his fleet back to meet its fate at Cavite.

Yet the advantages of the port of Subig and the development of the naval arsenal at Olongapo, on the eastern arm of that excellent harbor, had been studied by a series of special commissions from 1885 to 1898, at an annual expense of some $20,000 (Mexicans), which was duly charged to the Filipino budget each year. The removal of the naval establishment from Cavite was strenuously opposed by officers concerned about the comforts of the capital and by contractors anxious about investments in Cavite and profits to be made on supplies. A memorial opposing the transfer was prepared by some naval officer and printed at the expense of two well-known Filipino contractors about 1890. The political situation of the country is shown by the fact that both these agents, Osorio and Inocencio, being known as millionaires, were arrested and shot by sentence of a summary court-martial in September, 1896. Possibly this may account for the rarity of the volume issued in support of their interests.

A pamphlet containing an able refutation of their arguments was privately printed in 1894. It was written in 1891 by Captain del Rio, who seems to be a man of ability and is certainly the most unfortunate officer of his rank serving in the Philippines in 1898. Seven years after his plea for the fortification and equipment of a naval arsenal at Subig he was called upon to perform the miserable task of improvising defenses with inadequate means. The results did not inspire confidence, and in the council which decided upon the transfer of the ships to their last berth off Cavite, Captain del Rio was the only advocate of the plan of fighting at Subig. The majority of captains accepted the dreary argument that they must fight in shallow water to give their crews a chance of escaping to the shore.

The pamphlet printed in 1894 urges the fortification of Subig as a naval station and the abandonment of Cavite as lacking both the nautical and the military conditions required to place a fleet in security. Without placing too much stress on the alleged shoaling of the water, we may agree with the author when he denies that ships can be moved near the arsenal out of range of the enemy's cannon, as well as in the following opinion: "Huddling ships around the arsenal involves the demoralization of their crews without guarding them from the enemy's projectiles; it sentences them to a fate as inevitable as it is inglorious." Point by point he predicts the advance of an admiral "whose fleet is stronger than ours, but not twice as strong"; he will reconnoiter Subig, standing on in good heart if he finds that port vacant. If he finds the Spanish fleet at Cavite he will destroy the ships and the arsenal, and bombard Cavite at his leisure. The partisans of Cavite endeavor to present a plea for defending the entrances of Manila Bay; their plan includes seven batteries, the number actually installed on May 1; then, 1310 torpedoes and four first-class torpedo-boats. Moreover, a naval squadron is required, and Captain del Rio demonstrates that it must be at least equal to that of the enemy. For, as he asserts, the batteries will be isolated and incapable of mutual support if the enemy chooses to make successive concentrated attacks. The torpedoes are bound to go adrift in the swell and currents sweeping through these deep channels, and they will then be as dangerous to the vessels of the defense as to those of the attack.

Besides these sound theoretical considerations it may now be added that an unarmored squadron can safely run past any batteries which the resources of Spain could erect on the shores and islands of the Boca Grande. The demonstration has been made, and a tenfold increase in the efficiency of the batteries and the vigilance of their garrisons would not have checked the advance led by Admiral Dewey.

The argument in favor of Subig was resented as implying disregard for the wealth and importance of the capital. But our author points out that, since all the millions which the wealth of Manila represents can neither close the mouth of the bay nor make Cavite a safe shelter for a fleet, it is seeking the impossible to endeavor to protect a city on the open coast of a wide bay from the shells of a hostile squadron. The conservative view is expressed in the following proposition: "The creation of an arsenal at a distance from the site of one already installed, when the material and moral forces requisite are wanting, is a rash effort for the navy to undertake." Admitting the existence of Cavite and the scarcity of means, Captain del Rio insists upon the removal, "if the navy is to be spared a ruinous failure whenever circumstances impose the duty of mobilizing the forces provided by the nation." The argument for Subig might have been strengthened by applying the principles of strategic defense in connection with *ports de sortie* as presented in various discussions at the U. S. Naval War College since 1887. No squadron invading this coast and seeking to attack Manila could afford to neglect a fleet occupying Subig. Lines of communication would be threatened, scouts and colliers picked off, and ships engaged in military blockade would be neutralized and exposed to defeat if the balance of power became uncertain. These considerations apply with equal force to the fleet under Admiral Dewey in April and that under Admiral Camara which caused speculation in July. Both were maritime invaders and liable to checks under the rules of naval strategy.

The technical and financial details furnished by Captain del Rio show that from 1885 up to 1891 the equipment of the arsenal at Subig had cost $116,774 (Mexicans), and the commission's reports had cost $144,155. The commission was still reporting in 1898, but the installation had probably got ahead of the discussion in expenditures. Certain ranges of substantial shops and storehouses had been erected and a floating dock ordered in England. This dock, of the sectional, self-docking type, was ready for shipment at Newcastle-on-Tyne early in 1898, and the owners were anxious to sell it to the American Government or any purchaser prepared to pay the contract price of £35,000. Of course, no stone dock would answer in this land of earthquakes. A dredging plant was also under contract to be used in completing basins off the tract in the delta of the Rio Santa Rita, near the village of Olongapo. This delta seems exposed to floods, but we are assured that the water can be diverted into the mangrove swamps to the eastward or made to flow through the channel on the west side of the delta. It is admitted that the Bay of Subig cannot be connected with the capital by railway without vast expense. The direct route would lead over a chain of mountains into the delta of the Pampangas River. The most practicable route would branch from the northern section of the Dagupan railway. Obviously, all this discussion and demonstration has a certain value with reference to the future of the Philippines under American control. Whenever the situation can be regarded strictly from a naval standpoint Cavite must be allowed to decline, though a small coaling station might be kept up in Cañacao Bay. Of course, while the navy is employed as an adjunct to military and political enterprises in the provinces adjacent to Manila this transfer must be postponed, but when civil government is established and accepted, the strategic and nautical advantages of Subig should prevail over the political, social, and commerical claims of Manila.

A similar question was fought out about a century ago when a trivial naval establishment on the banks of the Pasig River in Manila was sacrificed to the development of the arsenal at Cavite. Powerful influences opposed the change. Navy yard billets had become the spoil of political adventurers and social parasites who would have to give up their places if work had to be accomplished. The remedy was heroic, considering the traditions of Spanish administration. The navy yard at San Blas in Mexico was closed and all its foremen and managers were transferred to Cavite, where they were able to do the state some service. Yet traces of the old system remain. The admiral commanding the station and squadron in the Philippines had his office and mansion in the San Miguel suburb of Manila, where he lived surrounded by a large staff of officers, selected for obvious family or social reasons in many instances. This involved the duplication of papers and employments, since the work had all to be done over again at Cavite in the office of the "Commandant of the Arsenal and President of the Administrative Board."

In the office file for April 29, 1898—the last day for which the correspondence of Cavite arsenal was duly registered and jacketed—there was found a series of documents illustrating the course of Spanish circumlocution. The commandant of the naval division of Yap in the Caroline Islands made requisition for a coal-lighter. The commandant-general of the station sent it to the commandant at Cavite, who assembled the Administrative Board to consider the affair; the naval constructor (*Ingeniero*) was directed by the Board, of which he was a member, to report as an expert on the project. His recommendation was duly adopted and forwarded, requiring the man at Yap to estimate the exact amount of material and labor required. In due time his estimate came back, and, passing through the same circuit, was sent to the Minister of Marine at Madrid. Thence came a decree from the Queen Regent of the realm, who, in the name of her son (q. D. g.), ordained that the said coal-lighter should be constructed with the number of boards, quantity of nails and days' work as specified. The total circumnavigation seems to have stopped at Cavite just six months after the original application. The existence of the coal-lighter remains problematic.

The navy secured its documents with white tape; the army, with stripes of red and yellow. Both use cumbrous forms and obsolete compliments in trivial reports and "expedients." The intrusion of another department of the national establishment appears in the printed forms of court-martial orders, which contain a clause requiring members to attend a "Mass of the Holy Spirit" in the chapel half an hour before the time set for the meeting of the court. Considering the facts that the charges are often based on testimony founded in torture, and that the sentences were generally cruel and unjust, this invocation seems somewhat out of place. The army regulations of Spain are perhaps the only ones containing diagrams of parades for the execution of the penalty of death and for the still more atrocious ceremony of military degradation. The history of Spain in the nineteenth century shows that such lessons have their natural effect on the officers who serve as judges or as "fiscals" in prosecuting military and civil offenders. The Official Gazette of Manila in 1897 and 1898 was full of proclamations threatening the life, liberty and property of deserters or civilians on the authority of junior officers of the army and navy detailed as judge-advocates of summary courts.

The complexity of naval administration is exhibited in every public office by shelves filled with carefully annotated and indexed volumes of "Laws relating to the Navy." The actual political system of Spain allows the Ministry to name and control a working majority in the Cortes and to pass all laws introduced. Bureaucrats seem to demand at least one stout volume for each year, and documents—if not facts—must be shaped according to their requirements. The foundation of all naval discipline is contained in the two volumes of *Ordmanzes Generales* of 1793, tall copies of which are found in every ship and in every administrative library in the arsenals. The amazingly systematic and complete form of this work suggests that it was drawn up in the reign of Charles III., the last period when Spain was governed with ability by a king who knew how to strengthen his cabinets by employing the talents of foreign adventurers, Italian and Irish. Yet this monumental code was responsible for the armadas which met Jervis at St. Vincent and Nelson at Trafalgar. Of course, successive accretions of arbitrary complexity have helped to further cripple the powers of later generations of naval officers. We may be thankful for the rough simplicity of Anglo-

Saxon ideals—for the tendencies which, in their best days, seem to prefer common-sense to beaurocratic counsels of perfection.

The cramping influence of this over-wrought administrative mechanism, combined with the failure of intellectual interests and industrial development to counteract the mediaeval obscurantism of the dominant forces in the Philippines, may account for the prostrate condition of the Spanish naval squadron in 1898. The navy had more than two hundred commissioned officers on that station, yet half the ships were out of repair or defective in equipment. Crews were untrained and incapable of marksmanship. Nepotism glares from the pages of the squadron naval register and there were visible efforts to establish easy routine as a mitigation of the pains of exile. The higher officers were better paid than those of like standing in the United States Navy and were luxuriously accommodated in official residences. By the lower grades tropical slackness seems to have been accepted in lieu of more substantial rewards. No strategic purpose and no technical studies seem to have directed the plan of campaign. Half the Archipelago remains unsurveyed, and the defensive conditions of the approaches to the capital and to the new naval arsenal at Subig seem to have been ignored by the responsible authorities until long after Admiral Dewey had concentrated his cruisers at Hong Kong. American naval officers will at least know what to expect if the example of their predecessors in the Philippines shapes the future of the new colonial administration.

Some notes on the history of naval campaigns in the vicinity of Manila may serve to conclude this rambling series of incidents and impressions. The adventurous navigation of Magellan and later explorers of the sixteenth century must be passed over without comment, except a reference to the fact that their crazy armadas seemed to run foul of the Philippines while in search of Japan or of the Moluccas, or Spice Islands. The first naval attack on the Spanish settlement at Manila was made by the famous Chinese pirate, Li-ma-hong, at the head of a fleet of sixty junks carrying some 4000 soldiers. He made several attacks in 1674, landing his troops at Parañaque and making successive attempts to storm the feeble breastworks of the town. He showed persistence and resource. For instance, he drew the fire and occupied the attention of the garrison by sending a flotilla of fire rafts to drift along the beach at night while his storming parties attacked by land. But he was beaten off and retired to the Gulf of Lengayen, where he established himself on shore, only to be driven off, a few months later, by the Spanish Captain, Salcelo.

The next invader was more terrifying, if not more formidable. A fleet of Hollanders, whom Philip II. had striven to punish as rebels and traitors, made its way into the Pacific and the two surviving ships reached Manila in 1600. Batteries covering the town of Cavite were hastily erected and two guns were mounted on Sangley Point, where we found their successors in 1898. The Dutch lay at Mariveles for two months, blockading the port and capturing various prizes. Finally the Spanish were ready, and two large galleons, each carrying a hundred men-at-arms besides the crew, closed with the Dutchmen off Mindoro. After some casual cannonading the Spanish boarded the Dutch flagship, carried the poop, and took the masthead flag and the ensign at the peak. The Dutchmen fought in the waist in their usual dogged manner. Their Captain-General, Oliver de Noort, roused their Dutch courage after several hours of sluggish fighting, and they drove the Spaniards back to their ship, which sunk as soon as they got on board. Their Captain-General was Dr. Antonio Morga, Justice of the Royal Court, who wrote a curious history of his brief naval career. It seems uncertain whether the ship went down because the Dutch had kept up a steady fire from their main deck, or because she was strained by the discharge of her own cannon. Anyhow, Dr. Morga had, as he tells us, to swim for four hours with the two captured flags wrapped round his waist before he and his trophies were rescued.

The Hollander made sail for Borneo with only forty-eight men alive, half of them wounded, six having been slain. He was able to refit and to complete his voyage round the world, the first of his sea-faring nation to perform that feat. His consort, the yacht known in the Spanish story as the Almiranta, the second in command of a fleet being called the Admiral in those days, was captured with thirteen out of her crew of twenty-five still alive. The prisoners were distributed among the convents to be converted and absolved from their heresies. Their captain remained impenitent, and so earned the right to have his name honorably mentioned. Lambert Vriesman and his men all shared the same fate, as they were duly garroted on the beach before Manila.

A generation later the Dutch held the Straits of Malacca and were established in the Moluccas to the southward and in Formosa to the northward of the Philippines. They had thus secured strategic command of the Eastern Archipelagoes. The Spaniards had never dared to trade by the route around the Cape of Good Hope, but had limited the trade of the Philippines to the annual galleon for Acapulco. The Dutch were now in position to intercept the traffic and threaten the Spanish dominion in the Far East. But they did not send the best ships to these waters, and the Spaniards claimed the tactical advantage in several inconclusive contests which took place about the middle of the century. (1640-1655.)

They attribute their partial successes to the strength of the hulls of their galleons, built in the Philippines of the hardest and heaviest timber in the world. Nowhere else could ship-building be carried on to equal advantage, as ships were cheaper as well as stronger than those built elsewhere. The cheapness was due to the use of forced labor—thousands of lives being sacrificed in getting out ship timber; the strength, to the lavish use of hard wood in the hulls. This may have accounted for the slowness which doomed them to frequent captures, and for the clumsiness which caused them to be cast away on so many inhospitable shores in Japan or among the Ladrones. Had not the trade of Manila been strangled by the rules imposed by authorities in Madrid, in Manila and in Mexico, the commerce of the islands might have built up a mercantile navy fit to serve as the basis of sea-power. But the Spanish genius did not manifest that tendency, nor did the theories of protection and colonial exploitation allow foreigners to trade to any Spanish possession.

The Dutch sent a fleet into Manila Bay about 1645, but their captain anchored before attacking Cavite. The ablest Governor of the Philippines of that century was then expiating his activities in the prison of Fort Santiago. From his windows he saw the Dutch squadron at anchor and declared that the enemy had missed his opportunity by this delay. A sudden attack would have been fatal, but there was time to collect powder and troops and to move ships under the batteries before the bombardment began. There was much cannonading for a day or two, but there was no decisive result. The invader was allowed to ravage the adjacent coast, but he took nothing from his attack on Cavite and did not assail the capital. In another engagement off Cape

Bolinao the Spanish victory was marred by the conduct of one captain, who ran away from the fight and burned his ship in a safe harbor—to save her from the enemy, according to his report. However, "being a nephew of the Governor," he was duly promoted for this action.

The conquest of Formosa by the Chinese corsair, Coxinga, who had gathered the remnants of Chinese opposition to the Tartar conquest, put an end to the Dutch enterprise in that region and gave Manila a breathing space. The pirate king of Formosa proposed to extend his conquests to the Philippines, but died in 1662, before he found time to equip a squadron for the purpose.

The pirates of Sulu and Mindanao occupied the attention of the local naval forces for two centuries more, but no serious shock to Spanish authority occurred until 1762, when an English fleet of thirteen vessels, carrying some 7000 soldiers, entered the Bay of Manila, bringing news of the declaration of war and demanding the surrender of the islands. The English landed below Malate, took Paco and Ermita, and planted batteries to breach the walls. The city surrendered in a few days. The Spaniards still tell tales of the archbishop who was acting as Governor-General, accusing him of being "a feeble and irresolute American," that is, a Mexican. Then there were traitors, and the English were aided by Chinese, by convicts, and by rebels. They are said to have fired 6000 shells and 30,000 round shot during the siege. An important rebellion encouraged by the invaders overran the northern provinces during the English occupation, but the natives nearer Manila were organized into bands led by Spanish soldiers and monks, and the foraging parties sent out from Manila were frequently annoyed by these guerrillas.

The archbishop had agreed to pay a ransom to save the city from pillage, and had drawn on Spain for part of the money. In 1764 peace was declared and the English restored Manila, as well as Havana, taken in the same year, to Spain. The Spanish Court felt strong enough to repudiate the archbishop's bond for indemnity. It was a common superstition among Englishmen, and even among Americans at Hong Kong in April, 1898, that this repudiated and outlawed claim gave England some sort of a lien on the Philippines, and that we might be warned off if we threatened Manila. Of course, no responsible or well-informed

Englishmen held this notion. The withdrawal of the English from the Philippines was due to a policy based on recognition of the strength of Spain under Charles III.—not to any local intimidation, though Spanish writers assure us that the English "had great luck in being able to quit a country that had cost them so much blood and in which they had won no more soil than that they stood upon." Such vain boastings would have been repeated had the Paris Conference made a different disposition of the Archipelago in 1898.

There were no more international contests in these regions until Admiral Dewey appeared on the scene. Rebellions succeeded each other at intervals of about twenty years, and the Spanish Navy had some share in suppressing them in the smaller islands of the Visayas group. In Luzon such affairs were left to the army. The navy also got the upper hand of piracy about 1870. Fast gunboats at last enabled the Spanish seamen to catch the Malay skiffs, and breech-loaders gave them a like advantage over the deadly edge-tools, the *campilans* and *krisses*, which had so long given the Moros the advantage in close encounter.

The navy had done its share in repressing the great rebellion which broke out in 1896. This work had not been of the most honorable character, and discipline and efficiency may have suffered during the hateful task of burning towns and shooting prisoners. Few, if any, officers had missed winning one or more crosses of naval merit in their campaigns. But the navy was in bad condition when the hour of battle arrived: some ships had rusted out in idleness; others had been strained by their own batteries while bombarding villages at ranges of 11,000 meters. Moreover, there were indications of distrust and discouragement in all the dispositions made to resist the American attack. There was no lack of warning, and Admiral Montojo had written a telegram to Madrid on the morning of April 30, announcing that he was making ready to meet the American fleet, which had passed Bolinao at dawn.

The preceding notes do not offer a closely knit narrative of the actions described. Still less do they abound in facile enthusiasm, in personal gossip, or in dramatic incident. All these things have been attempted—perhaps some have been accomplished—but there remain individual impressions and unofficial opinions which may invite discussion and therefore suggest instruction to those who form their own conclusions on a basis built up of such fragmentary testimony. Of the intense interest inspired by an event for which a whole naval career has been more or less a season of conscious preparation, there is no need to speak. The last verse of a noble poem written by an American woman on May 3, while all our friends were waiting in darkness, sums up one conviction which lay deep in the hearts of hundreds of men on that fair Sunday morning: "Sworn were we ever to this—now the hour and the test are at hand." And for that hour and that test there was confidence, because the Olympia bore the flag of a leader whom all knew to be strenuous, alert, and unwavering in his resolute advance. That trust made it good to be there, and will make the memory of that morning's work a precious inheritance to be transmitted to our children and to those who may be called upon to keep alive the traditions of loyalty to the Navy and to the Great Nation which we should be proud to serve.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EFFECT OF GUN-FIRE, BATTLE OF MANILA BAY, MAY 1, 1898.

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INTRODUCTORY.

This report on the Effect of the Gun-Fire of the United States Vessels in the Battle of Manila Bay, by the Intelligence Officer of the U. S. S. Baltimore, has lately been received. In transmitting it Admiral Dewey calls attention to the value of the information contained.

The conclusions drawn by Lieutenant Ellicott at the end of his report are particularly interesting.

RICHARDSON CLOVER,
Commander, U. S. N., Chief Intelligence Officer.

NAVY DEPARTMENT, *March 27, 1899.*

Approved:
A. S. CROWNINSHIELD, *Rear-Admiral, U. S. N.,*
Chief of Bureau of Navigation.

U. S. S. BALTIMORE, *Iloilo, P. I., January* 1, 1899.

SIR:—I have the honor to submit the following report on the effects of the gun-fire of the United States fleet upon the Spanish war vessels in the battle of May 1, 1898, and respectfully request that it be forwarded to the Office of Naval Intelligence. The report is based upon a personal examination of all the vessels, personal conversations with officers who served on them in the action, and extracts from Admiral Montojo's official report.

Reina Cristina.

This vessel was the flagship of Admiral Montojo during the greater part of the first engagement. She received a large concentration of gun-fire and was placed hors de combat by conflagrations fore and aft, the destruction of her personnel, the destruction of her steering gear, and the bursting of a shell in her superheater. She was then sunk by the Spaniards and abandoned in shoal water under the north wall of Cavite heading eastward, where she burned, with bulwarks awash. During the conflagration there were frequent heavy explosions. The injuries visible above water afterwards were as follows:

One large shell across bulwarks at break of forecastle, cutting away starboard lower boom.

One large shell swept bridge, apparently from starboard to port, and destroyed starboard search-light. This may have been the shell described by Admiral Montojo as destroying the steam steerer.

In the forward smokestack the following shells: One 8-inch low, one 8-inch high, one 6-pounder low, one 6-pounder high; and in forward escape pipe one 5-inch and one 6-pounder midway.

In ventilator forward of after smokestack, one 6-pounder waist high and one 6-pounder midway.

The after smokestack fell 60 degrees to port, probably caused by the large shell mentioned by Admiral Montojo as exploding in the superheater. This stack was struck, apparently while still upright, by one 8-inch shell low, two 6-pounders near the top, and one 5-inch midway.

Underneath topgallant forecastle one 8-inch shell entered near the deck and close under break of forecastle, going from port to starboard and forward at an angle of 45 degrees, and burst under the forecastle, a large fragment passing out on starboard side.

Two 5-inch shells also penetrated under the forecastle on port side well forward, 6 feet above deck, and burst.

One 5-inch shell entered on starboard side in same locality and passed out on port side without exploding.

The mizzenmast, although much burned, showed evidences of having been pierced six times, and the fore and main masts once, by shells of various calibers.

The starboard after-launch's davit was shot away, as if by a large shell.

An 8-inch shell pierced the shield of the port forward 16-centimeter gun, above and to left of the breech, and exploded, slipping the elevating arc band just its width to the rear and wrecking the elevating wheel, rod, and pinion on left side of gun. A fragment of this shell wrecked the elevating gear on the right side of the opposite gun. The portion of the shield penetrated sloped at an angle of about 30 degrees with the axis of the shell. The bursting of the shell about 2 feet in rear of its point of impact was co-ordinated by a huge hole torn upward in a sheet-iron bulwark rail arched over the sponson embrasure.

Admiral Montojo reports additional injuries as follows:

A shell burst on the forecastle, disabling all the crews of the four rapid-fire guns and driving splinters from the foremast which wounded the helmsman, who was steering on the bridge.

A shell burst on the orlop deck, setting fire to the lockers of the crew, who fortunately succeeded in putting out the fire.

The enemy . . . covered us with a hail of rapid-fire projectiles.

About half past 7 a shell completely destroyed the steam steerer.

Another shell exploded aft, putting nine men out of action.

. . . . Another carried away the mizzen truck and gaff, bringing down the ensign and my flag, which were immediately replaced.

Another shell burst in the wardroom . . . and destroyed the wounded who were there under treatment.

Another burst in the after ammunition room, filled the compartments with smoke, and prevented the coupling of the handwheel. It being impossible to keep down the fire, this ammunition room had to be flooded when the cartridges were beginning to explode.

Amidships . . . a large shell had penetrated the superheater, putting out of action a gunner's mate and twelve men who were serving the guns.

Another disabled the starboard bow gun.

. . . The fire forward was renewed by a shell which penetrated the side and burst on the orlop.

When many men had already been saved . . . a shell killed her heroic captain . . . who was directing the rescue of the crew.

Summing up, it is in evidence or officially recorded that the Cristina was struck by five 8-inch, five 5-inch, and thirteen other large shells, and by seven 6-pounder and nine other projectiles, or thirty-nine projectiles in all. These are not all, as Admiral Montojo reports having been covered by a hail of rapid-fire projectiles, and in conversation has estimated that the Cristina was hit about seventy times.

Castilla.

This vessel had developed such weakness in steaming to Subig Bay some days before the battle that she was not underway on the 1st of May, but in the beginning of the engagement was moored head and stern in the line of battle, her port broadside bearing. A string of iron lighters loaded with sand was moored in prolongation of Sangley Point to protect her water-line. During the engagement her bower chain was cut by a shell and from the impact of another shell she swung around till her starboard broadside was presented. Being a wooden vessel she was readily and repeatedly set on fire. About 10 o'clock, while the United States squadron was drawn off, her flag came down, either by design or accident, and she burst into flames fore and aft. She then sank until her main deck was awash, and her bulwarks and upperworks were completely consumed by flames. Her forward smokestack fell 60 degrees toward the starboard quarter, probably weakened, like the Cristina's, by the explosion of a large shell. Next to the Cristina she received the greatest injury from gun-fire. Injuries visible to inspection are as follows:

One 5-inch shell dismounted 37-millimeter gun on port forward bridge over sponson.

One 6-inch cut fore and aft beam over port forward gun sponson.

Seven small shells passed through forward smokestack.

Five small shells passed through forward drum room.

A large shell tore a 4-foot hole in the port side below the main deck and just abaft the port midship gun.

There is a similar injury on the starboard side, nearly opposite.

One 5-inch shell through the after smokestack.

Three 5-inch shells, close together, entered port side under main deck, abaft after smokestack.

One 6-pounder in after smokestack.

One 6-pounder in after escape pipe.

Two 5-inch entered port side between mainmast and after sponson.

One 5-inch passed through shield of 37-millimeter gun on port after bridge, over sponson, dismounting gun.

One 6-pounder cut forward part of upper edge of port after gun-sponson embrasure.

One 1-pounder cut forward vertical edge of same.

One 5-inch raked outside of starboard after sponson.

One 6-inch entered starboard side, under main deck, under midship gun.

There are two jagged holes, 4 feet and 1 foot in diameter, on starboard side under main deck, abreast after smokestack.

One 5-inch on starboard side under main deck, just abaft forward sponson.

One 5-inch through after side of forward starboard sponson.

One 5-inch through port after sponson, forward side, near deck.

Two scars of small shells on port after 16-centimeter gun shield.

Several small holes in after smokestack as if from fragments of a bursting shell.

Total, two 6-inch, twelve 5-inch, and four other large shells; three 6-pounders and sixteen other small shells; thirty-seven shells in all. Survivors tell of three 8-inch shells which burst on the orlop deck forward, amidships, and aft, causing fires which could not be controlled. This raises the known hits to forty.

Admiral Montojo states:

> The Castilla . . . had all her guns put out of action except one on the poop. . . . Riddled by shot and in flames from the enemy's shells, she was sunk and abandoned by her crew.

Survivors state that they were rescued by boats from shore which came off in obedience to a prearranged signal.

Don Antonio de Ulloa.

This vessel was not in repair on May 1, parts of her machinery being on shore. She was moored head and stern on the left of the Spanish line, in Cañacao Bay, just behind Sangley Point, her starboard broadside bearing, the port guns having been removed to be emplaced on shore. The low sandy point was expected to form some protection to her hull. She was only manned by men enough to fight her starboard battery, about half of her normal complement. She received but little gun-fire in the first engagement, but was riddled and sunk by the leading American ships in the second, and was abandoned with colors flying. She listed heavily to starboard just before settling, but righted on the bottom and lay with her poop awash, superstructure and forecastle above water. She had sent down yards and topmasts and these spars were on shore, except the fore yard, which had been untrussed but not sent down. The slings of this yard were cut during action and the yard fell across the forecastle on the sheet bits, breaking the beam at the break of the forecastle. The other injuries visible above water are as follows:

One 6-pounder entered under forecastle from forward, passed through the midship waist ventilator and burst in front of pilot-house, near deck.

One 8-inch raking shell entered at break of topgallant forecastle just under the deck and burst.

One 8-inch burst just under the superstructure deck, port side, on line with after end of pilot-house, a long half fragment passing out through the skin of the ship.

One 5-inch came over starboard rail a little farther aft and passed out through port bulwarks.

Six 6-pounders came over same way between superstructure and poop, and passed out through hammock nettings on port side.

One 8-inch passed clean through both sides, starboard to port, just under after break of superstructure deck and near mainmast.

One 6-inch came in starboard rail abaft mainmast and passed out through port hammock netting.

Seven large shells, probably 5-inch, ripped across superstructure deck, coming from direction of starboard bow.

One 8-inch across forecastle from starboard to port dismounted starboard 6-pounder gun, cutting away the mount.

One 6-inch shell passed through the shield of this gun.

Three 6-pounders from starboard to port passed through mount of port 6-pounder gun.

One small raking shell gouged skin of ship just forward of port sponson.

One large shell ripped poop in front of mizzenmast.

One large shell cut starboard binnacle stand.

Three large shells ripped poop deck, coming from direction of starboard bow.

Two large shells burst under poop, one near break and one aft, forcing up the deck.

The left side of after 4.7-inch gun-shield and the sponson rail were cut through by a 6-inch shell.

Total hits observable: Four 8-inch, three 6-inch, one 5-inch, and fourteen other large shells; ten 6-pounder and one other small shell; thirty-three projectiles in all.

Admiral Montojo states:

> The Ulloa . . . . was sunk by the holes made along her water-line by the enemy's projectiles.

Don Juan de Austria.

This vessel was sunk by the Spaniards behind Cavite arsenal, in Bacoor Bay, about two cables off shore abreast the west arsenal gate, after retiring from battle at the end of the first engagement. She was anchored by the port anchor and sank heading east, her topgallant forecastle above water and poop awash. After being abandoned, and while sinking, she was set on fire by a party from the Petrel sent for that purpose, and burned from the after engine-room bulkhead to the stern. Her starboard guns remained trained on the bow, and port ones on the beam.

Twelve empty 6-pounder cartridge shells lay at starboard forecastle gun and nine at the port one. A full box of 1-pounder ammunition remained on starboard side of superstructure near the pilot-house.

The injuries to this vessel were as follows:

Two 6-pounders, or smaller, scarred foremast.

One 6-pounder and one 5-inch entered port side under topgallant forecastle and burst without causing fire.

One 6-inch or 8-inch passed through superstructure deck under the bridge on port side and burst in the captain's galley, causing no fire, there being no woodwork in its neighborhood.

Another similar shell coming from same direction (one and one-half points abaft the beam) struck the superstructure deck near the corner of the pilot-house, glanced up and demolished the steering wheel and gear and engine telegraphs.

Two 6-pounders passed through the pilot-house, one from port to starboard low, and one from starboard to port halfway up.

One 5-inch cut through the mizzenmast about halfway up.

One 5-inch entered under port hawse pipe and burst, damaging port torpedo tube.

One 6-pounder entered at waterway under superstructure on main deck, port side.

One 5-inch entered port hammock netting abreast the mainmast.

One 6-pounder struck the rail abaft the port after 4.7-inch gun.

No further injuries were found after the vessel was raised. Summing up, she was hit by the following shells: Two 6-inch or 8-inch, four 5-inch, five 6-pounders, and two other small shells; thirteen projectiles in all.

The Austria has two bow torpedo tubes. When raised a 14.2-

inch Schwartzkopff torpedo was in the upper starboard outboard rack abreast the tube, and another lay on the deck in rear of the starboard tube without a head.

The Austria assisted in rescuing the men from the Castilla before retiring behind the arsenal.

Isla de Luzon.

This vessel and the Isla de Cuba maneuvered together on the Spanish right flank, more retired than the other vessels, circling together at considerable speed. The Luzon retired behind the arsenal at the end of the first engagement, anchoring near the Austria, and was sunk by her own crew. Her stern settled upon a submerged wreck, keeping the cabin above water and the top-gallant forecastle awash. After sinking her head lay northeast, she being about a cable's length southwest of the Austria. She was set on fire and burned by the same party which burned the Austria, the damage by fire being almost identical.

One 4.7-inch common shell, nose fuzed, remained in a rack between the after guns.

The injuries by gun-fire were as follows:

One large shell crossed her rail in wake of the two forward guns, disabling both guns.

One shell cut the chain topping lift of the fore gaff, letting the peak fall across the bridge.

The Luzon assisted the Cuba in rescuing men from the Reina Cristina before retiring behind the arsenal.

Admiral Montojo states that—

> The Luzon had three guns dismounted and some small injuries to her hull.

There seem, therefore, to have been three hits in all. No additional injuries could be discovered when this vessel was raised.

Isla de Cuba.

Admiral Montojo transferred his flag to this vessel when the Cristina was abandoned. After rescuing a part of the latter's crew she stood in behind the arsenal and was anchored by the starboard anchor a cable's length southwest of the Luzon, heading southeast. She was sunk by the Spaniards and burned by the Petrel's party in the same manner as the Austria and Luzon. Her main-battery guns remained trained on the bow. This vessel used armor-piercing shells from her after 4.7-inch guns, and these being the only guns of that caliber firing armor-piercing shells in the engagement, it must have been one of these which struck the Baltimore.

The injuries to the Cuba were as follows:

One 6-pounder through the pilot-house, starboard to port.

One shell cut away both forward vangs abreast the pilot-house rail.

One 6-pounder passed through under the topgallant forecastle without exploding.

One 6-pounder glanced from left side of starboard after 4.7-inch gun-shield.

One 6-pounder struck conning tower shoulder high, but did not penetrate.

Total hits, four 6-pounders and one unknown caliber; five in all.

The Cuba showed no additional injuries when raised.

Marques del Duero.

The Duero was in action in the left wing of the Spanish line and under steam. She assisted in rescuing the survivors of the Cristina and retired like the others behind the arsenal, where she was anchored close to the shore, about 800 yards west of the Cuba, heading east, and was there scuttled and abandoned. A party from the Petrel burned her. She was entirely gutted by fire and lies with bulwarks awash. She shows the following injuries from gun-fire:

One 8-inch shell entered close under topgallant forecastle deck, starboard side, and probably exploded.

One 6-inch very close to the latter, probably exploded; there being no evidences of egress by either of these shells.

One 6-pounder passed through midship-gun sponson, starboard side, forward of gun-shield.

One 6-pounder passed through after bulwarks, starboard side, down through deck and out port side near break of poop.

Admiral Montojo reports:

> The Duero had one engine crippled, as well as her 12-centimeter bow gun and one of her sponsons.

Thus there seem to have been five hits in all.

Velasco.

This vessel was undergoing extensive repairs and lay at moorings near the east water-front of Cavite arsenal. Her main deck in wake of the boilers had been removed to take out the latter, which were on shore. A new superstructure deck had been laid, but was unfinished. She had no steering gear in place. She took no part in the action. All her guns had been removed to be mounted in shore batteries. She was sunk by the Spaniards after the first engagement and then burned by a party from the Petrel. She lies on an even keel, heading westward, with bulwarks awash, and was not seriously injured by fire. There are evidences of the explosion of a quantity of small-arm ammunition on her deck aft, probably when she was burned. She was struck by one stray shell, which crossed her stern from port to starboard, carrying away the taffrail and kedge-anchor fluke on starboard quarter.

General Lezo.

Admiral Montojo states that this vessel was under repair and not in action. After the second engagement she was found anchored in Bacoor Bay, by the port anchor about 2 cables south of the Luzon, heading south and settling. She was burned by a party from the Petrel, her after magazine exploding with great violence, as well as some ammunition on deck. Her midship guns were missing and, although she had a bow torpedo tube, there were no evidences of torpedoes on board. The elevating gear of her 9-centimeter bow gun had been damaged by a projectile. She lies with main deck about 2 feet under water.

Argos.

The Argos was a hydrographic survey vessel lightly armed and not in the fight. She remained anchored behind the arsenal about 800 yards west of the Velasco, and was scuttled by the Spaniards and burned by a party from the Petrel. She settled till her bulwarks were awash, heading east. One large shell struck her starboard bulwarks at break of forecastle, passing outward.

SUMMARY OF HITS IN EVIDENCE OR OFFICIALLY REPORTED.

Name of vessel.	Number of hits.	Remarks.
Reina Cristina	39	Probably not more than half.
Castilla	40	Do.
Don Antonio de Ulloa	33	Do.
Don Juan de Austria	13	Complete record.
Isla de Cuba	5	Do.
Isla de Luzon	3	Do.
Marques del Duero	5	Probably more.
Velasco	1	Probably all.
General Lezo	1	Do.
Argos	1	Do.
Total	141	

Of these, thirteen were 8-inch, six 6-inch, and twenty-two others 5-inch or larger; thirty-one were 6-pounders and twenty-nine others smaller calibers.

The Spanish ships had removed all light spars, slung gaffs, and snaked rigging, but they went into action without unshipping awning stanchions, ridge ropes, or canopy frames, and they carried many of their boats. They were all painted gray except the Castilla. She was still white except her gun sponsons, which were gray, and her smokestacks yellow.

The killed and wounded, as nearly as I have been able to ascertain by painstaking inquiry, were as follows:

Vessel.	Killed.	Wounded.	Total.
Reina Cristina	130	90	220
Castilla	23	80	103
Isla de Cuba	..	2	2
Isla de Luzon	..	6	6
Don Juan de Austria	..	22	22
Don Antonio de Ulloa	8	10	18
Marques del Duero	0	0	0
Shore batteries	6	4	10
Total	167	214	381

Officers killed and included in the above: Reina Cristina, captain and six others; Castilla, one; Don Antonio de Ulloa, captain and two others.

The total casualties agree with Admiral Montojo's official report.

The following points in connection with my examination seem to be brought out or emphasized:

1. The sides of iron and steel-built cruisers do not arrest projectiles enough to explode them.

2. The incendiary effect of bursting 8-inch shells is great, and far greater than would seem proportionate to that of lower calibers.

3. At ranges over 2500 yards the gun-shields of cruisers are in no sense a protection, but insure the annihilation of the gun's crew and the disabling of the gun if struck by a large projectile.

4. Warships of the present day will generally be placed hors de combat by conflagration and the destruction of their personnel before they are sunk by gun-fire.

Very respectfully,

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Lieutenant, United States Navy, Intelligence Officer.

To the COMMANDING OFFICER, U. S. S. BALTIMORE.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WATCH, QUARTER AND STATION BILLS.

By Lieutenant-Commander Seaton Schroeder, U. S. N.

At the suggestion of the Board of Control I offer some observations upon the organization of ships of the present fashion, hoping to give rise to discussion and exchange of views.

The change from sailing vessels with auxiliary steam-power to full-power steamers necessitated immediate changes in our station bills. As a matter of course the "Topmen" had to go, and the parts of the ship were reduced without discussion to the forecastlemen and afterguard. Whether or not these two terms should be retained then became the subject of as acute discussion as any other one point.

The work aloft being reduced to practically nothing, excepting in a few small gunboats, and the gun-power becoming so very much greater, it is only natural that the energetic minds of progressive officers preserved their impetus and bounded ahead in the work of change, reaching the logical conclusion that, as the ship was built to carry the guns, the divisions should be the basis of organization. I think there is no doubt of the correctness of that principle, and I believe there are few officers now who do not assent to it. Somewhat different interpretations have, however, been put upon that apparently simple enunciation; some officers are of the opinion that to be consistent and in keeping with present conditions, the "Parts of the Ship" should no longer appear in the watch bill, being obsolete and useless; while others, less radical, are firm in the belief that those units are still of material use and convenience and should be retained. In one ship that I know of, a few years ago, the desire for change had been so powerful as to even do away with the starboard and port watches. That was, however, a sporadic case.

In the old sailing ships, including the auxiliary steamers immediately preceding the "New Navy," it was a matter of positive regulation, based upon sound principles, that the whole of any one gun's crew should never be drawn from one, nor even from only two, parts of the ship; without that precaution the destruction of one gun's crew might seriously cripple the part of the ship from which it was drawn, an important circumstance when sail might have to be suddenly shortened to a squall, or as quickly made in chase or retreat. As a consequence, a mizzen-topman would be seen temporarily fraternizing with a forecastleman at quarters, although each knew well that in the morning watch the other would exercise a considerable amount of discretion in heaving salt water and sand over his bright-work. Now, of course, that conflict of interests no longer exists. In fact, official suggestion is the other way. The leading paragraph in the Gunnery Drill Book for the New Armaments reads: "In distributing the petty officers, seamen and others to the guns and other stations in the several divisions, it is deemed advisable as a general rule * * * * that those stationed at the same gun or near each other at quarters should, as far as practicable, be drawn from the same part of the ship where their association has already been close." No other distribution would be tolerable at present. And the first immediate result is that (say in the Massachusetts) all of the first division are in the forecastle. Natural result, first question: "Why not call them simply first division?" Answer: "All the forecastlemen are not in the first division; there are others."

To provide for the efficient performance of the different characters of service, different units are created; we have boats' crews for boat work, companies for infantry drill, platoons for artillery, messes for eating, guns' crews for working the battery; it is certainly in line with that general plan to have parts of the ship for ship work. The guns are undoubtedly the *raison d'être* of the ship; children are the *raisons d'être* of mothers; but the ship, the mother that bears the guns, should not be neglected. Furthermore, as mentioned above, all the forecastlemen are not in the first division, nor are all the afterguard in the fourth; the navigator's division and the powder division have to be provided, and they are not and cannot be composed wholly of quartermasters, gunner's mates and other petty officers; the other men in these divisions must have some station on deck for coaling or cleaning or painting ship, hoisting boats, handling hawsers and awnings, and general deck work. The number of men in these two divisions is considerable, and should be still greater; and there is hope that it may be greater in future ships having more berthing space, as a recent station bill board, of which I was a member, recommended that the complements of ships should be such as to permit an entire powder division without drawing upon the engineers' people. This matter lies perhaps more with Congress than with the Department. In the navigator's division men are required in excess of quartermasters, for many duties—at least four in the steering engine room in case the deck wheels or steering engine are disabled, others for the search-lights, signalmen, messengers, range-finders, etc. Some of these requirements were recognized early in the Massachusetts, but it is astonishing how the possibility of meeting an actual enemy brings such necessities to mind. With so many extra people to be stationed on deck, it leads to confusion to call the first division, for instance, for ship work, when you also want all those of the navigator's and powder divisions who have ship duties on the forecastle, or to call the fourth division for gun work and explain that the navigator's and powder divisions need not answer.

Before joining the Massachusetts, I had considered suggesting to the captain the plan of having three parts, being prepared to give the good old name of waisters to the men who would live, move and have their being on the central upper deck; but the number of men required for the four eight-inch turrets and twelve six-pounders located there is conveniently divisible into two divisions, and parts of the ship, of about the same strength as the first and fourth divisions; so the first and second parts of the forecastle, and the first and second parts of the afterguard were adhered to, comprising respectively the 1st, 2nd, 3rd, and 4th divisions. This distribution of the men has worked satisfactorily in this ship for nearly three years, and coincides with the recommendation of the station bill board referred to, which has, I understand, been approved by the Bureau.

If I had it to do over again I would have four parts of the ship, distinctively and separately named, as being more convenient; waisters, upperdeckmen, casematemen seem adaptable terms. In smaller ships, or ships without an upper deck, it may not be necessary to subdivide the parts, particularly as there may only be officers and men enough for two divisions. It may well happen that a distribution into three parts will be conveniently adaptable to certain types of ships, possibly also harmonizing with three gun divisions. The principle of parts of the ship being accepted, it would be well to allow this amount of latitude as to the number of parts in preparing a general scheme for the entire service; although, of course, uniformity is desirable where it does not cause inconvenience or diminished efficiency.

The question as to whether the navigator shall have a division or a detail is of no great moment; the latter practice would relieve that officer of the trouble of making out clothing and money requisitions and inspecting bags and hammocks, and would put it on some one else; for infantry and artillery drills, his men would join their companies in either event; and for battle, collision, and fire quarters they have their own special duties with the chief boatswain's mate and chief quartermaster under the navigator, and it undoubtedly tends to increased efficiency for them to always muster together and know each other and realize that they have duties, and important ones. So there seems to be good reason why this unit should constitute a division.

Watch Bill.

The general plan of stationing the men being decided upon, the watch bill works out easily and logically. In this, as in all steps in organization, care should be taken to minimize the necessity of efforts of memory. Nothing can be simpler in this matter than to have the various groups or units each tally with a certain hundred; the 1st part of the forecastle, comprising the 1st division, should take the one hundreds; the 2nd part, the two hundreds; 1st of afterguard, comprising the 3rd division, the three hundreds; and so on. This leaves the numbers from 1 to 100 unappropriated, and a divergence from the old custom of making the captain of forecastle No. 1 appears desirable; instead, the petty officers should come first, beginning with the chief master-at-arms. It is in the interest of convenience to place in this group all petty officers, excepting those who stand watch with their part of the ship, and excepting the petty officers of the engineer branch, who should be grouped with the other people of that branch.

The marines can be put in to occupy the numbers between 500 and 599; and if the number of these, and the scarcity of sailors, and the arrangement of the battery, be such as to permit stationing them as a unit by themselves, they may comprise the 5th division. There are now so many marines found on board that it is generally necessary that a good many be put elsewhere than in any one gun division; some will inevitably have to be grouped with naval people. It is a matter much to be deprecated that the circumstance of these gallant men being of a separate and independent corps, wearing a different uniform and unable to perform seafaring duties, introduces serious difficulty in fitting them into the ship in such way as to produce useful results. The best solution will probably be found in putting some in the powder division; and the officer of that division may, in some ships, find it convenient to station them in such manner that they shall serve ammunition to guns manned by other marines; but such special arrangements are not generally practicable nor commendable, and having thus to harmonize discordant elements creates a difficulty which would not exist if the simple, natural law were followed of letting soldiers constitute the army and sailors constitute the navy. With our limited complements, sentiment, while duly respected, must give way to exigencies of an exacting service, and every man must be put where he will be of the greatest value, mixture of uniforms and traditions to the contrary notwithstanding. The men who organize, handle and fight our ships and are directly and wholly responsible for their efficiency in peace as well as in war, would hail with great satisfaction the existence of but one uniform, one fraternity, one service, one past, present and future history.

Next comes the engineer branch, or whatever it may be called under the *fin-de-siècle* organization imposed by the *personal* bill; and in watching these, a departure is suggested from what has been a general custom. Instead of attempting to watch them according to their steaming divisions (or sections, as they should preferably be called), which would constantly be changed, it is recommended to put their petty officers in the 600's, firemen in the 700's, and coal passers in the 800's. The reason for that is this: When a ship goes to sea, the men of this branch are necessarily changed around in their steaming sections by the chief engineer to meet conditions and requirements which are constantly changing, owing to the greater or less number of boilers in use, to some men being on the sick list, to special details for outside stations such as blower engines, evaporators, ice machines, etc. It is impossible to change their watch numbers each time, and the result is that any attempt to watch them according to their steaming sections becomes a dead letter. The method proposed is in operation on board the Massachusetts, and works to the satisfaction of all concerned.

The messman branch comes next, and, as fifty numbers are ample, they can be put from 900 to 949, leaving 950 and above for the bandsmen in a flagship.

The powder division, as may be noticed, is not distinctively numbered in any group of a hundred in this scheme. Being composed of men belonging to so many other groups—petty officers, seamen, coal passers, mess attendants, etc.—that would manifestly not be in accordance with the governing theory, and to attempt it would make the entire plan inoperative; there is no one part of the ship to which they could all belong. The same applies to the navigator's division.

In a bill framed in this manner, there is no watch number of over three figures. Even in vessels so small as to have only two gun divisions, and no 2nd parts, it is as simple to number the firemen's bags and hammocks 700, and mess attendants' 900, as 400 or 500; and where it produces no actual inconvenience, uniformity is a good thing, and the numbering suggested above appears well suited to ships of all classes.

In some ships the method of watch numbering has been refined down more than suggested above; and there is much to commend this method as applied in those ships. The organization is in divisions and parts of divisions; the first digit of the watch number indicates the division; the 2nd, the part of division; the others, the number in the part. For instance, No. 142 would indicate the 2nd number in the 4th part of the 1st division; No. 4112, the 12th man in the 1st part of the 4th division; No. 8332, the 32nd man in the 3rd steaming section of the engineer's division. Certain chief petty officers and petty officers first and second class have letters instead of numbers. Incidentally it will be observed that the watch is indicated by the 2nd digit, the starboard watch of the different parts being called the 1st and 3rd parts, and the port watch, the 2nd and 4th parts. At the first inception of this idea I understand that the plan was to extend it so that the gun number should be indicated in the watch number; but this suggestion cannot be too strongly condemned; the division officers should be free to station their men according to their capabilities, which they can determine much better than the executive officer or any one else; they should be furnished with a list of their men, and be at liberty to put them at any gun and in any station that they consider them best fitted for; and as changes are very apt to be frequently made in the interest of efficiency, such changes should certainly not entail changes of watch numbers, carrying with them changes in bags, hammocks, boats, and possibly messes.

Objection has been raised to this method as at present carried out, on the ground that the information contained in the 3rd and 4th digits is valueless; but this cannot be considered a very valid objection as long as nothing in the way of simplicity is sacrificed in imparting such information. An objection which can be urged with some force is that some of the watch numbers consist of four figures; the use of letters also seems a pity; also, the 2nd digit must be misleading in the engineer's division, because even if the plan of watching them by steaming sections be followed, those sections will exist only on paper, and the 2nd digit will give no correct clue to the man's actual watch-standing section; lastly, it seems more simple to have the watch indicated by the last figure.

Incidentally it will be observed that the application of this method to an organization containing parts of the ship will call for four such parts, each being further subdivided into two watches; this will facilitate the setting of quarter watches. Applied to the bill recommended in this paper, the 2nd digit would have no function, because in each division there is only one part, divided into two watches; the 2nd part of the forecastle, for instance, comprises the 2nd division, and in it all watch numbers begin with 2. At the same time an equally minute subdivision does practically exist in the Massachusetts, each part of each watch being in two unofficial sections; and during a certain period in last spring quarter watches were kept at the guns, formed of those sections. Standing quarter watches is, however, not of frequent occurrence, and it is perhaps a question if a more efficient quarter watch would not be formed by, for instance, the port watch of the

1st and 3rd divisions, relieved by the starboard watch of the 2nd and 4th divisions, rather than by half of one watch of each of the four divisions.

Messes.

The subject of messing is an important one. It is assumed that the general mess system will remain; the restriction is onerous that only 25 per cent. of the rations shall be commuted, still, no one who has been shipmates with it would ever consent to going back to the old way. The formation of messes, however, is none the less necessary. The experiment has been tried of accepting the term "General Mess" in its widest meaning; namely, to the effect that any man can sit down anywhere, at any table; but I have been told by one executive officer that he had found this to be a failure. It certainly seems rational to suppose that it would be so. If messes are formed from the parts of the ship (or divisions), the men of that part continue to be thrown together, and get to know each other better, and this must conduce to increased comfort and good table manners. The galley cooks, who are responsible for the issue of the meals in fair proportions to the mess cooks, must positively know beforehand the strength of the different messes; and unless the same number of men always sit at each table, no equitable distribution of food is possible. Also, if arranged in permanent messes, it is better known to the mess cooks (who are drawn from the same part) if men are away in boats or on watch, and better arrangements can be made for saving their meals or serving them ahead of time.

The chief petty officers, of course, mess by themselves, and it is better to except them from the general mess. For most reasons it is also better that the petty officers, 1st, 2nd and 3rd class, should mess by themselves. Objection is sometimes made to this on the score that petty officers should mess with unrated men to preserve order; but this does not appear to me to be important and it may make the other messes too large. Enlisted men are apt to be trustworthy just as far as they know they are trusted. In the Massachusetts, petty officers are not present at other messes, and offenses against table manners have been extremely rare. Still, letting the coxswains, or some of them, mess with their parts of the ship may be desirable, and it may be a means of equalizing the sizes of the messes. An eye should be had to this, of course, to equalize the work of the mess cooks and to facilitate the distribution of food at the galley by the galley cooks. In this ship it was found convenient to put some of the 3rd-class petty officers, or people like the seaman in charge of hold, jack of the dust, barber, etc., in the 2nd-class mess. As a rule, these petty officers' messes chip in and give their mess cooks half a ration or something like that, but as it amounts to very little per man, and as they all do alike in that respect, no hardship is worked to a 3rd-class man by putting him in a 2nd-class mess.

An exception may well be made in the case of the marines, all of whom (non-commissioned officers and privates) mess together, excepting the 1st sergeant; and this appears to give more satisfaction than messing the non-coms. with the other petty officers.

The only practical way to mess the firemen and coal passers is by their steaming sections, which change every time the ship gets underway; the sections going on watch must have their meals ahead of time, and to arrange this for parts of three messes would make confusion. In the actual working, the chief master-at-arms is furnished with the lists each time by the engineer's yeoman. The ability to arrange shifting messes in this limited way is one of the many incidental advantages of the general mess system.

Powder Division.

In organizing the powder division with the comparatively light crews furnished our ships, it is generally necessary to draw from the engineer's people in order to have a strong enough force to do the work. Every consideration of efficiency demands that this contingent should not be a shifting detail, but a permanent one. With the exception of a few mechanics to attend turret-training or other engines within the limits of the powder division, the work devolving upon the detail is entirely a manual labor, requiring strength and endurance; it is not necessary that oilers or water-tenders or other skilled men should be taken away from their legitimate and important duties in the engine and fire rooms; coal passers should be assigned, and certain ones permanently detailed by watch numbers. It has been argued in opposition to this system that when steaming, a certain number of coal passers will always be on watch, and they will be dirty on getting to their stations. The force of this is undoubted; but in a fighting ship everything should be subordinated to fighting efficiency; with a permanent detail, the officer of the powder division knows his men (not only for battle, but also for collision and fire), and they know their duties and have but the one thing to remember, and that is to get as quickly as possible to their one station when the calls are sounded. With a shifting detail, with the calls sounding near the time of relieving a watch, the men might be in doubt as to which station to go to; and the division officer has to make out a triple bill, and have a game of three-card monte to find out which detail would come.

In turret ships it may be expedient to have the ammunition supply for some of the turrets controlled and effected by these turret gun divisions, independently entirely of the powder division. This has been the case on board the Massachusetts for the 13-inch turrets, with the farther result that the 1st and 4th divisions have in that way been brought up to the strength of the 2nd and 3rd, whose 8-inch turrets are supplied by the powder division. The construction of the ship is such as to make this arrangement practically unavoidable, as the 13-inch magazines, shell-rooms and handling rooms are quite isolated from the regions inhabited by the powder division, and the officer of the latter division would be wholly dependent upon the turret officers for efficient control.

A central station messenger service, composed of active, intelligent and clear-voiced men or boys, will be found of almost absolute necessity; and they and the man in charge of the central station should, of course, be in the powder division. This service will require about four messengers in a battleship or large cruiser—at least until our means of interior communication are considerably improved.

Care of Double Bottoms, Compartments, Etc.

The care of the double bottoms, empty cofferdams, etc., may very properly be distributed among the various divisions, in such a way as to equalize the work as far as possible, assigning to each the compartments best located relatively to it. As an illustration, the allotment in the Massachusetts is as follows: The 1st division has the forward trimming tanks, the double bottom just abaft them, and the two forward cofferdams on each side below the side armor; the 4th division, the after trimming tanks, and two after cofferdams on each side; the 2nd and 3rd, the cofferdams between the 1st and 4th divisions; powder division, three double bottoms under the forward magazines and shell rooms; engineer's division, the double bottoms under their part of the ship.

It does not appear necessary nor desirable to station men regularly for this; the division petty officers, under the approval of the division officers, consider that work a sort of permanent "call," and put men at it whom they excuse from answering other calls; in this way the routine is quickly established, and the results are satisfactory, and the petty officers get just that much more opportunity for the exercise of discretion and the assumption of responsibility—something still very much needed in our service.

The plan has also been found convenient and efficient of charging the orlop deck patrol with the cleaning of the ammunition passages, making the detail sufficiently large to carry out both the police and military duties of that post.

Collision, Fire and Clear Ship for Action.

In preparing the different bills for executing the various evolutions or meeting the various emergencies, the fundamental principle is now undoubtedly recognized that the divisions are the basis of all organization. This carries with it the corollary that the men should at all times be commanded by the same officers.

Next to not having enough men to perform a certain duty, the worst condition is in having too many. Whether at collision quarters, fire quarters, or clear ship for action, every precaution must be taken against congestion of men or material. When the Navy was first confronted with water-tight doors and hatches and with the problem of closing them expeditiously, it is possible that the importance of the evolution suggested stationing more men for that work than was afterwards found advisable. All doors and hatches cannot be closed at once, because in every group the men who close the remote ones must have an exit through the nearer ones, which therefore must be kept open for them. If, therefore, plenty of men are detailed for the remote ones, so that no probable contingency would leave them unattended to, the nearer ones will always have more than enough. The powder division, and the engineer's division, each in its own bailiwick, will probably always be found strong enough to provide for every contingency below, and no one else should be permitted there.

While on this matter of the number of men necessary to close heavy armored hatches, which are usually the final ones in each group, it is somewhat germane to the subject to allude to the dangerous proposition to provide mechanical appliances by which these can be dropped or closed very quickly by one person, thus hastening the completion of the evolution—at the cost of probably defeating entirely the object sought. If the men who are stationed to close the remote doors and hatches know and appreciate that one person, intelligent or the reverse, could close the near ones on them, there would be but one result: the remote ones would remain open. Station bills must be made out with strict reference and deference to human nature. No appliance should be allowed on board (a big ship at all events) by which it would be possible to close the armored hatches in less than about two minutes; this is imperatively demanded for the safety of the ship, as otherwise no organization could prevent possible disaster with human nature as it was in the beginning, is now, and probably ever shall be.

At a fire the tendency of a man with a nozzle is to rush at it, and dangerous crowding may result. The number of available streams is so large in every part of the ship that it was found advisable to insert in the fire bill of the Massachusetts the following: "But no hose shall be led below from the main deck, and no man from the gun divisions shall go below the main deck for gratings or for any other purpose until a special order to that effect is given by the executive officer, officer of the deck, or officer of the powder division. And the officers of all divisions will carefully prevent any undue crowding, confusion or congestion of lines of hose, * * * ."

In clearing ship for action also, the powder division should be left alone to receive all material passed below, and stow it where designated, and to do all work of preparation below. On deck the division officers are responsible for the complete preparation of the parts of the ship where their divisions are located. In the engine and fire rooms the chief engineer is likewise responsible and should not be troubled. If coal has to be trimmed down from upper to lower bunkers, each division should send a party down, and the number of men for this should be stated in the general bill. Too much centralization is to be deprecated. The nature of the work of clearing a ship for action is such that any attempt to do the various things by watch numbers would prove fruitless; the station bill should state clearly and precisely everything that is to be done by each division, and each division should then be held responsible.

Boats and Battalion.

Finally we come to the boat bill and the landing organization. There is some difference of opinion in the service about these; but I am under the impression that the majority of officers favor adhering to the excellent rule that, so far as is possible, the divisions shall continue to be the basis, and that the officers shall always command the same men, ashore as well as afloat. The argument advanced by those who are opposed to this is that if a couple of boats' crews, or a company, should be away, the division from which they are drawn would be crippled, and that the ship would be left in a more defensible condition if they were drawn in small numbers from all the divisions. On the other hand it is urged that two complete divisions, for instance, are more reliable and more efficient than four half-manned ones. What appeals very strongly to me also is the conviction that when any evolution is to be performed, from furling awnings to landing the battalion, the organization should be such as to best ensure the success of the evolution rather than a superior condition of affairs in no wise connected with the prime object in view.

Even if the principle of diffusion prevail, it will be limited in its application, because its strongest advocate will probably not recommend carrying it to the logical point of sprinkling the marines among the other companies; this is interdicted by the difference of uniform and inharmonious *esprits de corps*. Having thus to stop short at an incomplete phase of organization shows again a vital defect in administration—an obstacle in the way of perfect efficiency. If any one blue-jacket company be short of full strength, files can be added from any other blue-jacket company, but not from the marine; if the marine company were short, it would have to remain so, or if the number of files in that company would just fill the other companies, they would still all have to go in that depleted condition because of the co-existence of two organizations which cannot mix—an unfortunate heirloom from bygone conditions. When the time shall come that the error is recognized of expecting men to perform well the widely differing duties of two wholly separate and distinct professions; when one professional engineering establishment shall exist, and one professional nautico-military; when there shall be but one uniform worn on board of our ships; and when all military officers shall share watch, boat, division and double bottom duty, so as to leave no one unemployed;—then will we have an ideal correlation of forces which shall indeed make the modern warship a triumph of mind over matter, and the handling of its powers a tribute to the value of organization.

> Chacun à son métier;
> The cobbler to his last,
> The gunner to his linstock,
> And the cook to the foresheet.

By stationing men in the boats which hang abreast of their divisions and their parts of the ship, the boats will naturally be better taken care of, and the men will man them more conveniently; and the officers being stationed in the same way will keep them and their men together. A convenient plan is to detail all the men in any one part of the ship for those boats; when called away, the officer of each boat takes only the number specified for the designated service (distant service or cutting out). In abandoning ship the men should go in the same boats as at arm and away; and the rest of the ship's company will have to be divided among all the boats according to their capacity. Dinghies' crews will presumably never arm and away, although men are stationed in them; the supernumeraries in the companies are enough so that, in the improbable event of forming companies when away for "cutting out," there would still be enough men from each division to form its company without the dinghies' crews.

The vast majority of cases of landing the battalion would be under circumstances which would permit, and in fact call for, simply transporting the companies in boats loaded to maximum safe capacity, and towing them ashore with the steamers. This need not appear in the station bills posted about the ship, nor in the men's station billets, as it is quite unnecessary to add to the efforts of memory. In practice, when the battalion is to be landed, the adjutant's call is sounded, the companies are formed, and the officers are notified, or reminded, in which boats to embark their companies and detail boat-keepers.

In order to save efforts of memory, it would be well for the running boats' crews to be the same as for arm and away and abandon; but in practice this is almost impossible. In a heavy ship there are some fifty men with regular stations in armed boats, who are on special details of ship duty which prevent their being in running crews; these details comprise mess cooks, messengers, signalmen, dynamo boys (for instruction), store-room keepers, etc. If the rigid rule were adopted that running crews should be the same as arm and away, then, whenever a man in a running boat was made a mess cook or signalman, etc., it would be necessary, in order to put him in a launch or some infrequently used boat, that his watch number should be changed, frequently to the extent of changing his division, which would be injudicious in its bearing upon the efficiency of the division; and the amount of work in shifting bags and hammocks for all these frequent changes would be very great. As a matter of fact, not the slightest difficulty or confusion arises from having the running crews separate and distinct. The coxswains, of course, are the same for all kinds of service. And there is no practical difficulty in having the gig's crew likewise the same; it is well as a rule to handle the gig's crew very tenderly, and as they do not take their turn with other men on special ship details, they can be assigned by watch numbers; this is made easier by having them all of the same rating—apprentices, for example, who make a very good gig's crew.

I have heard of an entirely different system of routine boat duty, the advantages of which are not patent to me. This consists in having no crews at all, but in making out a working party each day of a certain number of men who will stand by and man any designated boat. It is evident that such temporary details can have no interest in their boat, either cultivated or enforced, and the coxswains must have a hard time keeping the boats clean and property intact.

Regarding the companies and platoons, the increase in their strength by the last drill regulations complicates the problem slightly. In the largest ships in the service, with the complements that it is possible to give them now, the divisions are not strong enough to form complete companies of fifty-four each; considering the number of boat-keepers and probable absentees, companies thus formed would be very rarely full. In the Massachusetts, since receiving the new order, the junior division (the 3rd) has been broken up and distributed among the other companies, making four large units. By this arrangement the 2nd, 3rd and 4th companies are each some 15 or 20 men in excess, who are available for boat-keepers or are left on board. In case of dire necessity these remnants could be collected and sent off as a reinforcement under the command of the junior division officer, forming a complete company possibly, if the ship's complement were full and no sick list. But the regular organization thus forms a full battalion of four companies, the marines being the 1st. If legislation should permit a slight increase of complements in the future, five complete companies could be formed in ships of this class.

Suggestions.

Following is a suggestion for a watch bill for a ship of the Massachusetts type, with her present complement, the watch numbering being in accordance with the report of the station bill board. At the end of the paper are also summaries of the various station bills which appear to be successful in this ship.

I apprehend that it may be suggested in criticism of the watch bill that the parts of the ship appear to be the foundation and comprise the divisions, instead of the reverse. This is not really the case, as may be seen from closer examination. The larger unit must comprise the smaller; it is more convenient to follow this form, in which, for instance, all the 1st division can be seen at a glance (except a few petty officers), and all the forecastlemen also, than to have only a division on each page, and to have to pick out the forecastlemen from the navigator's and powder divisions as well as from the 1st. All the station bills are made out by divisions, and not by parts of the ship, and therefore the quarter bill is absolutely the foundation in fact as well as in theory.

It will be observed that in each group of 100, the various ratings are grouped in individual tens or twenties according to the number allowed; this is in the interests of uniformity and convenience. The watch numbers of the coxswains are so arranged as to bring them nearest to their boats as located in the Massachusetts; and the leading petty officer in each part is the one least apt to be called away for boat work. In these matters, of course, ships differ, and regard must be had to the boat stowage in each case.

The messes are made out simply according to the ratings, and, as suggested in the body of this paper, variations to suit individual complements will be desirable for the purpose of equalizing their strength. Putting all the coxswains in other messes would reduce the 3rd-class mess to 20, which is rather small, and would raise No. 6 mess, for instance, from 26 to 28; whereas taking out the captain of hold, jack of the dust, barber, and hospital apprentices would reduce the 3rd-class mess from 32 to 27, and raise No. 3 (2nd-class) mess from 15 to 20.

The column "Actual Rate" is of great convenience to keep the ratings straight; as, for instance, the number of landsmen is apt to be largely in excess of complement, and the seamen correspondingly short; or several gunner's mates, 3rd class, may be present in place of gunner's mates, 2nd or 1st class.

The entries in the column "Special Detail" are not as a rule dependent upon the corresponding watch number; they would be entered in pencil in the ship's bill, and are only given here as an indication of the probable requirements.

The principal points which will naturally assert themselves in dividing the battery into divisions are: facility of supervision by the division officers; minimum variety of classes or calibers in any one division; ammunition supply; maintenance of divisions of equal strength; equitable and symmetrical distribution of routine ship work. The ammunition supply of heavy turrets is apt to be more easily supervised by the turret officers than by the powder division officers, and the natural resulting propriety of putting the men who do that work in the gun division may further assist in equalizing the strength. Following the rule that men should be assigned to guns located in their own part of the ship, if any guns are given to the marines, they should be, if possible, in some one part of the ship that they can take care of, and for which the work will not call for any knowledge or skill other than that which they are called upon to possess. In the Massachusetts they have the main deck inside the casemate, manning the guns there (four 6-inch and two 6-pounders), and helping keep that part of the ship clean. There being more than required for that battery, a certain number are detailed for the powder division; but the casemate is their part of the ship, the police corporal being responsible for the proper condition of the paint work under the general supervision of the master-at-arms, 1st class, in the same way that the captains of the forecastle and afterguard are responsible under the boatswain's mates, 1st class.

In many ships it may be found that a logical assignment will result in some one part of the ship having a larger amount of work in cleaning and general maintenance than some other. In this case the gun divisions should still be kept as nearly as possible of equal strength (on account of boats, companies, etc.), and the necessary increase in the strength of the corresponding part of the ship made up by putting most of the navigator's and powder divisions there.

At arm and away no boat should carry people of more than one company. It will be observed that in the suggested watch bill this is the case except in the 3rd division, which is split up into different companies, and the sizes of boats of that division in the Massachusetts are such that one boat has unavoidably to carry parts of two companies. Before the increase in the size of companies this was not necessary.

In laying off the watch bill in the book, it is well to leave blank lines between groups of ratings, to provide for the contingency of the complement being changed, or of having additional men on board temporarily for passage or special duty.

It will also be found to be a great comfort and convenience to keep in the front part of the book numbered lists, corrected to date, of the men grouped in their ratings, so as to tell at a glance what vacancies or excess exist in any rating. For example:

Boatswain's Mates, 2nd Class, 4.

1. Patrick Kinneavy.
2. Henry Delin.
3. Samuel Shelton.
4. ....

This shows one vacancy in this rating. Or:

Landsmen, 34.

1. Timothy Grass.

* * * * * * * * *

35. Hay Seed.
36. Red Clover.

showing two landsmen in excess.

The figures in excess of the number allowed should be in red ink, appealing immediately to the eye. Occasional verification of these lists by comparison with the watch bill will save much trouble; without this precaution it may some day take several hours of examination to reconcile the weekly report of vacancies.

Of the signalmen, two should be in the navigator's division, for the reason that they would have the skill due to practice, and have more familiarity upon relieving those on watch; the same two would conveniently constitute the signal squad of the landing force. It is worth while to change watch numbers to effect this. It would, in fact, be well to have all six signalmen in that division; but this will not be found easy to keep up in the North Atlantic Squadron, where changes in ships' companies are so frequent; on a foreign station it can be done without serious inconvenience.

The three seamen who stand watch in the steering engine-room at sea, including the one who has charge of it, would preferably also be in the navigator's division; in case of quarters, especially at night, the one on watch will then not have to leave his station to go to a gun. They have no connection with the powder division, and are wholly beyond the jurisdiction and control of the powder division officer. The training and practice (weekly at the very least) of these men, and in fact of the whole division, in connecting up with all the different points of control and for the different applications of power, are under the immediate instruction by the chief quartermaster and navigator.

The special details of gunner's mates should be by watch numbers, as their battle stations depend upon them. The four electricians at present allowed (though not yet provided) in the complement are not enough; the chief has too much to do to stand watch, and they should not be in less than four watches, for it must be remembered that the dynamo room is always hot, and these people do not stand watch only when at sea like the engineer's people, but are at it every day throughout the year; a gunner's mate has therefore to be added to the dynamo room party. The two apprentices marked as under "Dynamo Instruction" are almost a necessity, to help the chief electrician in the care and maintenance of fuses, circuit breakers, lamps, portables, motors, etc., beside cleaning the storerooms; incidentally they pick up a good deal of information and become useful assistants.

In some ships I understand the search-light crews have been drawn from the dynamo people; but I see no necessity for that, nor any advantage; it does not take an electrician to handle a search-light, and the electricians are needed for the dynamos, circuits, ammunition hoists and other motors, and should be in the powder division. In some instances, also, the dynamo people have been in the navigator's division; but it seems more rational to have the powder division include all men who are stationed where that division officer can control them. It is true that the navigator is in charge of the electrical outfit, but he could certainly not go down into the bowels of the ship in action to attend to dynamo troubles.

A large ship requires eight side-cleaners; and it is best to detail seamen or ordinary seamen for that work. They cannot well be kept in running boats, and therefore landsmen should not be detailed, because these should get all the practice possible in boats as well as at the battery. While the work of the side-cleaners is supposed to be finished before quarters, still, when the days are short, they do not manage to get through, or rather they do manage not to get through; do what you will, those briny *demi-mondains* do contrive to escape some drills.

It may be convenient to make one of the bag-room keepers lamp-trimmer; there are plenty of applications for the extra pay.

In the commissary department the chief yeoman should be a man of the steward class (it would indeed be better if his title were ship's steward); being in general charge, he has control of the galley cooks, two of whom will be required in the bakery and should be specially selected for that. Then, to look out for the storeroom and canteen, a reliable landsman may be needed, or possibly one of the galley cooks may be spared for it; at all events, one man will be enough if the order prohibiting the issue of beer remains unrescinded.

The one marine in the gig at abandon ship is the captain's favorite orderly.

The engineer crews of steamers are apt to be specially selected and more or less permanent, and they should be so if possible; and the same crews should go for arm and away; it is therefore better not to attempt to station those two men by watch numbers in those boats.

The selection for chief petty officer of the battalion will, of course, depend upon the personalities of the available men. The chief boatswain's mate and chief gunner's mate are most apt to be well adapted.

The man in charge of the central station in action and at "all hands" should also be especially chosen, as he should have a cool head, a clear voice (with American accent), a knowledge of the ship, and familiarity with the significance of all messages which might be sent through the station. As the desired qualities may be found in a non-com., or yeoman, or exceptionally reliable apprentice, it is not a detail that can be made by watch number.

For convenience in reference at any time, as well as to constitute a system of checks which are as desirable in this as in all bookkeeping, corrected lists of all special details should follow the watch bill in the book, the watch numbers and names being filled in in pencil where the detail is not permanently dependent upon watch numbers: Messengers, signalmen, dynamo party, mess cooks, side-cleaners, captains of head, berth deck sweepers, battalion details (color guard, pioneers, etc.). Then bring in the navigator's and powder divisions, collated by watch numbers in ink, but with stations in pencil, so as to be free to change; then the boats' crews, one on a page: Running crews, with numbers and names in pencil; arm and away crews, by watch numbers alone in ink; and the additional detail for each boat for abandoning ship, by watch numbers, in ink.

In preparing the various station bills for distribution in frames about the ship, there is a certain temptation to make out combination bills which shall give in more or less detail the station of every man for every evolution; this is done in some ships the mere mention of which would carry weight and even conviction. In the Massachusetts, however, that method was given up, and two blue prints each are posted of the collision bill, fire bill, clear ship for action bill, and boat bill. The first three are given just as they stand in the book; all men specially stationed, being given their stations by the division officers, can at any time refresh their memory by looking at these bills, which are blocked off in divisions; and, while a man has to look through his division to find his number, which takes him longer than if arranged by numbers in tabular form, yet he gains by unwittingly seeing how many other men and what men are grouped with him at a certain door at collision quarters, or a certain line of hose in case of fire. This is especially of service to the petty officers. The posted boat bill consists simply of double columns giving the arm and away and the abandon ship crews, arranged by watch numbers in numerical order, for each boat; so it is easy for a man to find his own number and at the same time see who is with him; and the coxswains can verify their crew lists at any time. The running crews are, of course, not posted, as they are continually changing from month to month or oftener.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special D
2		M. at A. 1st C.		Pow.		2d Launch.		2	Main Dec
4		M. at A. 3d C.		"	2d Steamer.	2d Steamer.	Col.	4	Berth. Deck.
12		Chief Yeo.	Equip.	"		2d Steamer.		1	
14		"	Capt. Writer.	"		Gig.		1	
16		Yeo. 2d C.	Nav. Writer.	"		2d Cutter.		3	
22		B. M. 1st C.		2	2d Whale.	2d Whale.	4	2	Upper D
24		"		4	4th Cutter.	4th Cutter.	3	2	Q'r Deck
32		G. M. 1st C.		Pow.		2d Steamer.		2	Torpedo
34		"		4		2d Steamer.		2	Sec. Bat
36		"		4		Gig.		2	
38		G. M. 2d C.		2		2d Launch.		3	
40		"		3		2d Dinghy.		3	
42		"		2	2d Steamer.	2d Steamer.	Ord.	3	Sec. Bat
44		G. M. 3d C.		1		2d Cutter.		4	
46		"		4		2d Cutter.		4	Store R
48		"		2		1st Punt.		4	5th Div. Batter
52		Elec. 1st C.		Pow.	2d Steamer.	2d Steamer.	Ord.	2	
54		Elec. 2d C.		"		2d Launch.		3	
62		Chief. Q. M.		Nav.		2d Launch.		1	
64		Q. M. 2d C.		"	2d Steamer.	2d Steamer.	Col.	3	
66		Q. M. 3d C.		"		2d Punt.		4	
72		C. M. 1st C.		Pow.		Gig.		2	
		Shipw't.		"	2d Steamer.	2d Steamer.	Amb.	4	
		B'ksmith.		"	1st Steamer.	1st Steamer.	Pion.	2	
78		Sail M.		"	2d Steamer.	2d Steamer.	Amb.	2	
80		Paint.		"		4th Cutter.		4	
82		Lds.	Barber.	"	1st Steamer.	1st Steamer.	Com.	4	
84		Bugler.		Nav.	2d Steamer.	2d Steamer.	Bugler.	4	
92		Hosp. App.		Surg.	2d Steamer.	2d Steamer.	Amb.	4	

STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	Chief M. at A.		Pow.		1st Steamer.		1	
	M. at A. 2d C.		"		1st Launch.		3	Main Deck.
	Chief Yeo.	Com.	"		1st Launch.		1	Central Station.
	"	Pay.	"		1st Launch.		1	
	Yeo. 1st C.	Ship's Writer.	Nav.		1st Cutter.		2	
	Chief B. M.		Nav.	1st Steamer.	1st Steamer.	Chief P. O.	1	
	B. M. 1st C.		1	2d Cutter.	2d Cutter.	2	2	Forecastle.
	"		3	2d Steamer.	2d Steamer.	Col.	2	Bridge. Deck.
	Chief G. M.		Pow.		1st Launch.		1	
	G. M. 1st C.		"		1st Launch.		2	Torpedoes.
	"		1	2d Steamer.	2d Steamer.	Ord.	2	Armory.
	"		1		1st Dinghy.		2	
	G. M. 2d C.		2		1st Cutter.		3	
	"		3		1st Cutter.		3	
	"		3		3d Cutter.		3	Sec. Battery.
	G. M. 3d C.		4		3d Cutter.		4	
	"		3	2d Steamer.	2d Steamer.	Ord.	4	5th Div. Battery.
	"		Pow.		5th Cutter.		4	Dynamo.
	Chief Elec.		"		5th Cutter.		1	
	Elec. 2d C.		"		1st Whale.		3	
	Q. M. 1st C.		Nav.		Balsa.		2	
	Q. M. 3d C.		"	2d Steamer.	2d Steamer.	Col.	4	
	Chief C. M.		Pow.	1st Steamer.	1st Steamer.	Pion.	1	
	C. M. 3d C.		"	2d Steamer.	2d Steamer.	Amb.	4	
	Shipw't.		"		5th Cutter.		4	
	P. & F.		"	1st Steamer.	1st Steamer.	Pion.	2	
	Paint.		"	2d Steamer.	2d Steamer.	Amb.	4	
	Sea.	Charge Hold.	"		Gig.		4	
	Lds.	J. of D.	"	1st Steamer.	1st Steamer.	Com.	4	
	Hosp. Stew.		Surg.	2d Steamer.	2d Steamer.	Amb.	1	
	Hosp. App.		"	Gig.	Gig.		4	

FORECASTLE.

FIRST PART. PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Spe Det
					Running.	Arm & Away.	Abandon.			
102		Cox.		1	2d Cutter.	2d Cutter.	2d Cutter.	2	4	
104		Cox.		1	5th Cutter.	5th Cutter.	5th Cutter.	2	4	
112		Sea.		1		1st Cutter.	1st Cutter.	2	6	
114		"		1		1st Cutter.	1st Cutter.	2	6	
116		"		1		1st Cutter.	1st Cutter.	2	6	Windl
118		"		1		2d Cutter.	2d Cutter.	2	6	
120		"		1		2d Cutter.	2d Cutter.	2	6	
122		"		1		2d Cutter.	2d Cutter.	2	6	
124		"		1		5th Cutter.	5th Cutter.	2	6	
126		"		1		5th Cutter.	5th Cutter.	2	6	Side Cl
132		O. S.		1		1st Cutter.	1st Cutter.	2	6	
134		"		1		1st Cutter.	1st Cutter.	2	6	
136		"		1		2d Cutter.	2d Cutter.	2	6	
138		"		1		5th Cutter.	5th Cutter.	2	6	
140		"		1		5th Cutter.	5th Cutter.	2	6	
152		App.		1		1st Cutter.	1st Cutter.	2	6	Turret
154		"		1		1st Cutter.	1st Cutter.	2	6	
156		"		1		2d Cutter.	2d Cutter.	2	6	
158		"		1		2d Cutter.	2d Cutter.	2	6	
160		"		1		5th Cutter.	5th Cutter.	2	6	
162		"		1		5th Cutter.	5th Cutter.	2	6	
164		"		1		5th Cutter.	5th Cutter.	2	6	
166		"		Nav.		Gig.	Gig.	2	6	
168		"		Pow.		2d Dinghy.	2d Dinghy.	2	6	
172		Lds.		1		1st Cutter.	1st Cutter.	2	6	Mess C
174		"		1		2d Cutter.	2d Cutter.	2	6	
176		"		1		2d Cutter.	2d Cutter.	2	6	
178		"		Pow.		5th Cutter.	5th Cutter.	2	6	Capt. of

FIRST PART. STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Running.	Arm & Away.	Abandon.	Co.	Mess.	Special Detail.
	B. M. 2 C.		1		1st Cutter.	1st Cutter.	2	3	
	Cox.		1	1st Cutter.	1st Cutter.	1st Cutter.	2	4	
	Sea.		1		1st Cutter.	1st Cutter.	2	5	
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		Nav.		5th Cutter.	5th Cutter.	2	5	
	O. S.		1		1st Cutter.	1st Cutter.	2	5	Side Cleaner.
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	Capt. of Head.
	App.		1		1st Cutter.	1st Cutter.	2	5	
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		Nav.		Gig.	Gig.	2	5	Signalman.
	"		Pow.		1st Dinghy.	1st Dinghy.	2	5	
	Lds.		1		1st Cutter.	1st Cutter.	2	5	Orlop Deck Sweeper.
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		Pow.		5th Cutter.	5th Cutter.	2	5	Mess Cook.

SECOND PART. PORT WATCH.

	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Running.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	S I
202		Cox.		2	2d Launch.	2d Launch.	2d Launch.	4	4	
204		Cox.		2	2d Whale.	2d Whale.	2d Whale.	4	4	
212		Sea.		2		2d Launch.	2d Launch.	4	8	
214		"		2		2d Launch.	2d Launch.	4	8	
216		"		2		2d Launch.	2d Launch.	4	8	
218		"		2		2d Launch.	2d Launch.	4	8	
220		"		2		2d Whale.	2d Whale.	4	8	Ba
222		"		2		2d Whale.	2d Whale.	4	8	
224		"		Nav.		1st Steamer.	1st Steamer.	4	8	
232		O. S.		2		2d Launch.	2d Launch.	4	8	B.I
234		"		2		2d Launch.	2d Launch.	4	8	
236		"		2		2d Whale.	2d Whale.	4	8	
238		"		2		2d Whale.	2d Whale.	4	8	Me
240		"		2		1st Steamer.	1st Steamer.	4	8	
252		App.		2		2d Launch.	2d Launch.	4	8	
254		"		2		2d Launch.	2d Launch.	4	8	
256		"		2		2d Launch.	2d Launch.	4	8	
258		"		2		2d Launch.	2d Launch.	4	8	
260		"		2		2d Whale.	2d Whale.	4	8	
262		"		2		2d Whale.	2d Whale.	4	8	
264		"		2		2d Whale.	2d Whale.	4	8	
266		"		Nav.		Gig.	Gig.	4	8	
272		Lds.		2		2d Launch.	2d Launch.	4	8	
274		"		2		2d Launch.	2d Launch.	4	8	Si
276		"		2		2d Whale.	2d Whale.	4	8	
278		"		Pow.		2d Whale.	2d Whale.	4	8	C

SECOND PART. STARBOARD WATCH.

me.	Rate Allowed.	Actual Rate.	Div.	BOAT. Running.	Arm & Away.	Abandon.	Co.	Mess.	Special Detail.
	B. M. 2 C.		2		2d Launch.	2d Launch.	4	3	
	Cox.		2	1st Steamer.	1st Steamer.	1st Steamer.	4	4	
	Sea.		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		1st Steamer.	1st Steamer.	4	7	Side Cleaner.
	O. S.		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	Mess Cook.
	App.		2		2d Launch.	2d Launch.	4	7	Dyn. Inst.
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	5	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		Nav.		1st Steamer.	1st Steamer.	4	7	Signalman.
	Lds.		2		2d Launch.	2d Launch.	4	7	Mess Cook.
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		Pow.		1st Steamer.	1st Steamer.	4	7	B.D. Sweep'r.

FIRST PART. PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Spe Det
					Running.	Arm & Away.	Abandon.			
302		B. M. 2 C.		3		1st Launch.	1st Launch.		3	
304		Cox.		3	2d Steamer.	2d Steamer.	2d Steamer.	3	4	
312		Sea.		3		1st Launch.	1st Launch.	2	10	
314		"		3		1st Launch.	1st Launch.	2	10	
316		"		3		2d Steamer.	2d Steamer.	3	10	
318		"		3		2d Steamer.	2d Steamer.	3	10	Side
320		"		3		1st Whale.	1st Whale.	4	10	
322		"		3		1st Whale.	1st Whale.	4	10	
324		"		3		1st Whale.	1st Whale.	4	10	
332		O. S.		3		1st Launch.	1st Launch.	2	10	
334		"		3		1st Launch.	1st Launch.	2	10	
336		"		3		2d Steamer.	2d Steamer.	3	10	Mess
338		"		3		1st Whale.	1st Whale.	4	10	
340		"		3		1st Whale.	1st Whale.	4	10	
352		App.		3		1st Launch.	1st Launch.	2	10	
354		"		3		1st Launch.	1st Launch.	2	10	
356		"		3		2d Steamer.	2d Steamer.	3	10	
358		"		3		2d Steamer.	2d Steamer.	3	10	
360		"		3		1st Whale.	1st Whale.	4	10	
362		"		3		1st Whale.	1st Whale.	4	10	
364		"		3		1st Whale.	1st Whale.	4	10	
366		"		Nav.		1st Whale.	1st Whale.	Sig.	10	Sign
372		Lds.		3		1st Launch.	1st Launch.	2	10	Mess
374		"		3		2d Steamer.	2d Steamer.	3	10	
376		"		3		2d Steamer.	2d Steamer.	3	10	
378		"		Pow.		1st Whale.	1st Whale.	4	10	B.D.

FIRST PART. STARBOARD WATCH.

...me.	Rate Allowed.	Actual Rate.	Div.	BOAT. Running.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	Cox.		3	1st Launch.	1st Launch.	1st Launch.	2	4	
	Cox.		3	1st Whale.	1st Whale.	1st Whale.	4	4	
	Sea.		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	3	9	
	“		3		1st Launch.	1st Launch.	3	9	Gen. Store.
	“		3		1st Whale.	1st Whale.	4	9	
	“		Nav.		1st Whale.	1st Whale.	4	9	
	O. S.		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	3	9	
	“		3		1st Launch.	1st Launch.	3	9	Side Cleaner.
	“		3		1st Whale.	1st Whale.	4	9	
	App.		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	3	9	Dyn. Inst.
	“		3		1st Launch.	1st Launch.	3	9	
	“		3		1st Launch.	1st Launch.	3	9	
	“		3		1st Whale.	1st Whale.	4	9	
	“		3		1st Whale.	1st Whale.	4	9	
	“		Nav.			1st Whale.	Sig.	9	Signalman.
	Lds.		3		1st Launch.	1st Launch.	2	9	Bag Room Lamps.
	“		3		1st Launch.	1st Launch.	2	9	
	“		3		1st Launch.	1st Launch.	3	9	
	“		Pow.		1st Whale.	1st Whale.	4	9	Mess Cook.

SECOND PART. PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Running.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Specia
402		B. M. 2 C.		4		3d Cutter.	3d Cutter.	3	3	
404		Cox.		4	3d Cutter.	3d Cutter.	3d Cutter.	3	4	
412		Sea.		4		3d Cutter.	3d Cutter.	3	12	
414		"		4		3d Cutter.	3d Cutter.	3	12	
416		"		4		3d Cutter.	3d Cutter.	3	12	
418		"		4		3d Cutter.	3d Cutter.	3	12	
420		"		4		4th Cutter.	4th Cutter.	3	12	
422		"		4		4th Cutter.	4th Cutter.	3	12	
424		"		4		4th Cutter.	4th Cutter.	3	12	
426		"		Nav.		4th Cutter.	4th Cutter.	3	12	
432		O. S.		4		3d Cutter.	3d Cutter.	3	12	Side
434		"		4		3d Cutter.	3d Cutter.	3	12	B. Swee
436		"		4		4th Cutter.	4th Cutter.	3	12	
438		"		4		4th Cutter.	4th Cutter.	3	12	Mess
440		"		4		4th Cutter.	4th Cutter.	3	12	
452		App.		4		1st Dinghy.	1st Dinghy.	3	12	
454		"		4		1st Dinghy.	1st Dinghy.	3	12	
456		"		4		2d Dinghy.	2d Dinghy.	3	12	
458		"		4		2d Dinghy.	2d Dinghy.	3	12	
460		"		4		3d Cutter.	3d Cutter.	3	12	
462		"		4		3d Cutter.	3d Cutter.	3	12	
464		"		Nav.		4th Cutter.	4th Cutter.	3	12	Signa
466		"		Pow.		Gig.	Gig.	3	12	
472		Lds.		4		3d Cutter.	3d Cutter.	3	12	Mess
474		"		4		3d Cutter.	3d Cutter.	3	12	
476		"		4		4th Cutter.	4th Cutter.	3	12	Orl Swee
478		"		Pow.		4th Cutter.	4th Cutter.	3	12	

SECOND PART. STARBOARD WATCH.

me.	Rate Allowed.	Actual Rate.	Div.	BOAT. Running.	Arm & Away.	Abandon.	Co.	Mess.	Special Detail.
	Cox.		4	4th Cutter.	4th Cutter.	4th Cutter.	3	4	
	Cox.		4	Gig.	Gig.	Gig.	3	4	
	Sea.		4		3d Cutter.	3d Cutter.	3	11	
	"		4		3d Cutter.	3d Cutter.	3	11	
	"		4		3d Cutter.	3d Cutter.	3	11	Side Cleaner.
	"		4		3d Cutter.	3d Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	
	O. S.		4		3d Cutter.	3d Cutter.	3	11	
	"		4		3d Cutter.	3d Cutter.	3	11	Mess Cook.
	"		4		4th Cutter.	4th Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	
	App.		4		1st Dinghy.	1st Dinghy.	3	11	Turret Boy.
	"		4		1st Dinghy.	1st Dinghy.	3	11	
	"		4		2d Dinghy.	2d Dinghy.	3	11	
	"		4		2d Dinghy.	2d Dinghy.	3	11	
	"		4		3d Cutter.	3d Cutter.	3	11	
	"		4		3d Cutter.	3d Cutter.	3	11	
	"		4		3d Cutter.	3d Cutter.	3	11	
	"		Nav.			3d Cutter.	3	11	Signalman.
	"		Pow.		Gig.	Gig.	3	11	
	Lds.		4		3d Cutter.	3d Cutter.	3	11	Orlop Sweeper.
	"		4		3d Cutter.	3d Cutter.	3	11	
	"		4		4th Cutter.	4th Cutter.	3	11	Mess Cook.
	"		Pow.		4th Cutter.	4th Cutter.	3	11	

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special]
502		Serg.		5	2d Launch.	2d Launch.	1	14	
504		"		5		2d Launch.	1	14	
506		Corp.		5	2d Cutter.	2d Cutter.	1	14	
508		"		5		2d Launch.	1	14	
510		Music.	Fifer.	5	2d Launch.	2d Launch.	1	14	
512		Priv.		5	2d Launch.	2d Launch.	1	14	
514		"		5	2d Launch.	2d Launch.	1	14	
516		"		5	2d Launch.	2d Launch.	1	14	
518		"		5	2d Launch.	2d Launch.	1	14	
520		"		5	2d Launch.	2d Launch.	1	14	
522		"		5	2d Launch.	2d Launch.	1	14	
524		"		5	2d Launch.	2d Launch.	1	14	B. D. Sweepe
526		"		5		2d Launch.	1	14	
528		"		5		2d Launch.	1	14	
530		"		5		2d Launch.	1	14	
532		"		5		2d Launch.	1	14	
534		"		5		2d Launch.	1	14	
536		"		5		2d Launch.	1	14	
538		"		5		2d Launch.	1	14	
540		"		5		2d Launch.	1	14	
542		"		Pow.	2d Launch.	2d Launch.	1	14	
544		"		"	2d Launch.	2d Launch.	1	14	Mess Co
546		"		"	2d Launch.	2d Launch.	1	14	
548		"		"	2d Launch.	2d Launch.	1	14	
550		"		"	2d Launch.	2d Launch.	1	14	
552		"		"		2d Launch.	1	14	
554		"		"		2d Launch.	1	14	
556		"		"	2d Cutter.	2d Cutter.	1	14	
558		"		"	2d Cutter.	2d Cutter.	1	14	
560		"		"	2d Cutter.	2d Cutter.	1	14	

STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	1st Serg.		5	1st Launch.	1st Launch.	1	1	
	Serg.		5	1st Cutter.	1st Cutter.	1	13	
	Corp.		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	Police.
	Music.	Drum.	5		1st Launch.	1	13	
	Priv.		5	1st Launch.	1st Launch.	1	13	
	"		5	1st Launch.	1st Launch.	1	13	
	"		5	1st Launch.	1st Launch.	1	13	
	"		5	1st Launch.	1st Launch.	1	13	
	"		5	1st Launch.	1st Launch.	1	13	
	"		5	1st Launch.	1st Launch.	1	13	
	"		5	1st Launch.	1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		1st Launch.	1	13	
	"		5		Gig.	1	13	Orderly.
	"		Pow.	1st Launch.	1st Launch.	1	13	
	"		"	1st Launch.	1st Launch.	1	13	
	"		"	1st Launch.	1st Launch.	1	13	
	"		"	1st Launch.	1st Launch.	1	13	
	"		"	1st Launch.	1st Launch.	1	13	Mess Cook.
	"		"	1st Launch.	1st Launch.	1	13	
	"		"		1st Launch.	1	13	
	"		"	1st Cutter.	1st Cutter.	1	13	
	"		"	1st Cutter.	1st Cutter.	1	13	
	"		"	1st Cutter.	1st Cutter.	1	13	Mess Cook.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Spec
					Arm & Away.	Abandon.			
602		Chief Mach.		Eng.		2d Steamer.		1	
604		"		Pow.		Gig.		1	
612		Mach. 1st C.		Eng.		2d Cutter.		15	
614		"		"	2d Steamer.	2d Steamer.	Ord.	15	
616		B'ksmith.		Pow.		2d Launch.		15	
620		W. T.		Eng.		2d Steamer.		15	
622		"				2d Steamer.		15	
624		"		"		2d Cutter.		15	
632		Mach. 2d C.		Eng.	1st Steamer.	1st Steamer.	Pion.	15	
634		"		"		4th Cutter.		15	
636		Oiler.		"		2d Launch.		15	
638		"		"		2d Launch.		15	
640		"		"		4th Cutter.		15	
642		"		Pow.		2d Steamer.		15	

STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	Chief Mach.		Eng.		1st Steamer.		1	
	"		"		1st Launch.		1	
	Chief Yeo.		"		1st Steamer.		1	
	Mach. 1st C.		Eng.		1st Cutter.		15	
	"		Pow.		1st Steamer.		15	
	Copper-smith.		Eng.		1st Steamer.		15	
	Boiler-maker.		"		1st Steamer.		15	
	W. T.		"		1st Steamer.		15	
	"		"		1st Steamer.		15	
	"		"		1st Cutter.		15	
	Mach. 2d C.		Pow.	2d Steamer.	2d Steamer.	Ord.	15	
	"		Eng.		3d Cutter.		15	
	Oiler.		"		1st Cutter.		15	
	"		"		3d Cutter.		15	
	"		"		5th Cutter.		15	
	"		Pow.		1st Steamer.		15	

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Specia
702		Fire 1st C.		Eng.		2d Steamer.			
704		"		"		2d Steamer.			
706		"		"		2d Steamer.		16	
708		"		"		2d Launch.		17	
710		"		"		2d Launch.		18	
712		"		"		Balsa.			
714		"		"		2d Dinghy.			
752		Fire 2d C.		Eng.		2d Steamer.			
754		"		"		2d Steamer.			
756		"		"		2d Launch.		16	
758		"		"		2d Launch.		17	
760		"		"		2d Launch.		18	
762		"		"		Balsa.			
764		"		"		2d Dinghy.			

STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	Fire 1st C.		Eng.		1st Steamer.			
	"		"		1st Steamer.			
	"		"		1st Steamer.		16	
	"		"		1st Launch.		17	
	"		"		1st Launch.		18	
	"		"		1st Launch.			
	"		"		1st Dinghy.			
	Fire 2d C.		Eng.		1st Steamer.			
	"		"		1st Steamer.			
	"		"		1st Steamer.		16	
	"		"		1st Launch.		17	
	"		"		1st Launch.		18	
	"		"		1st Launch.			
	"		"		1st Dinghy.			

COAL PASSERS.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Spec
802		C. P.		Eng.		1st Steamer.			
804		"		"		2d Steamer.			
806		"		"		2d Launch.			
808		"		"		2d Launch.			
810		"		"		2d Cutter.			
812		"		"		2d Cutter.			
814		"		"		4th Cutter.			
816		"		"		4th Cutter.			
818		"		Pow.		2d Whale.			
820		"		"		2d Whale.		16	
822		"		"		2d Dinghy.		17	Bag
824		"		"		2d Dinghy.		18	
826		"		"		Balsa.			
828		"		"		Balsa.			
830		"		"		Balsa.			Mess
832		"		"		2d Punt.			
834		"		"		2d Punt.			
836		"		"		2d Punt.			
838		"		"	1st Steamer.	1st Steamer.	Pion.		Mess
840		"		"	1st Steamer.	1st Steamer.	Pion.		

COAL PASSERS.

STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	C. P.		Eng.		1st Steamer.			
	"		"		1st Steamer.			
	"		"		1st Launch.			
	"		"		1st Launch.			
	"		"		1st Cutter.			
	"		"		1st Cutter.			
	"		"		3d Cutter.			
	"		"		3d Cutter.			
	"		Pow.		5th Cutter.			
	"		"		5th Cutter.		16	
	"		"		5th Cutter.		17	
	"		"		1st Whale.		18	
	"		"		1st Whale.			Mess Cook.
	"		"		1st Dinghy.			
	"		"		1st Dinghy.			
	"		"		Balsa.			
	"		"		1st Punt.			
	"		"		1st Punt.			
	"		"		1st Punt.			
	"		"	1st Steamer.	1st Steamer.	Pion.		Mess Cook.
	"		"	1st Steamer.	1st Steamer.	Pion.		

MESSMEN.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Spec
912		Cab. C.		Pow.		Gig.		Cab.	
922		W. R. C.		Pow.		2d Steamer.		W. R.	
924		M. A.		Pow.		2d Launch.		W. R.	
926		"		Pow.		2d Cutter.		W. R.	
928		"		Pow.		4th Cutter.		W. R.	
930		"		Pow.		2d Steamer.		W. R.	
942		J. O. C.		Pow.		2d Whale.		J. O.	
944		M. A.		Pow.		2d Cutter.		J. O.	
952		W. O. C.		Pow.		2d Launch.		W. O.	
962		S. C. 2d C.		Pow.		2d Launch.			I
964		"		Pow.	2d Steamer.	2d Steamer.			
966		S. C. 3d C.		Pow.		1st Steamer.	Com		
968		S. C. 4th C.		Pow.		2d Cutter.			

STARBOARD WATCH.

ne.	Rate Allowed.	Actual Rate.	Div.	BOAT. Arm & Away.	BOAT. Abandon.	Co.	Mess.	Special Detail.
	Cab. S.		Pow.		Gig.		Cab.	
	M. A.		Pow.		Gig.		Cab.	
	W. R. S.		Pow.		1st Steamer.		W. R.	
	M. A.		Pow.		1st Launch.		W. R.	
	"		Pow.		1st Cutter.		W. R.	
	"		Pow.		3d Cutter.		W. R.	
	"		Pow.		5th Cutter.		W. R.	
	J. O. S.		Pow.		1st Whale.		J. O.	
	M. A.		Pow.		1st Cutter.		J. O.	
	"		Pow.		3rd Cutter.		J. O.	
	W. O. S.		Pow.		1st Launch.		W. O.	
	M. A.		Pow.		1st Whale.		W. O.	
	S. C. 1st C.		Pow.		1st Launch.			
	S. C. 2d C.		Pow.	1st Steamer.	1st Steamer.	Com		
	S. C. 3d C.		Pow.		1st Steamer.			
	S. C. 4th C.		Pow.		1st Cutter.			
	"		Pow.		3d Cutter.			Baker.

Collision Bill (Summary).

The signal is three or more shrieks of the siren, and the mechanical alarm gongs; then one long blast of the bugle indicates injury forward; three long blasts, injury aft.

The closing of all water-tight doors and hatches outside of the engine and boiler rooms and their dependencies, is done by the powder division; also automatic and other valves in the main air-duct. Every man in the division is stationed by watch number at some one door, hatch, valve or pump. The work of closing hatches will begin at the lowest compartment of each group, and the work of closing doors and air-ports will begin at the extreme ends of the ship forward and aft, the various parties uniting and working together as each group is completed. Each party will keep in mind to make sure that no one is shut in below. The parties working aft from forward and forward from aft, will finally form on the berth deck in B 106, ready to open such compartments as may be designated. The last hatch closed from below the berth deck will be the armored hatch from the ammunition passage B 63 to B 106. The two hatches to the main deck from C 101 will not be closed until the powder division and engineer's division shall all be reported up in obedience to orders to that effect.

The closing of all W. T. doors and hatches in the engine and boiler rooms and their dependencies will be done by the engineer's division; and the engineer on watch will have the available steam pumps connected with the flooded compartment or with the compartment into which the flooded one drains.

The collision mat is handled by the 1st division if the injury is forward, and by the 4th division if the injury is aft. In either case the port watch of the division will carry the mat to the point indicated and leave it there and form on the opposite side of the deck ready to man the hogging line or render such assistance as may be required; the starboard watch will provide and prepare the guys, hogging line and distance line, take charge of the mat and get it overboard.* The chief boatswain's mate, with six men specially and permanently detailed, will in all cases get the hogging line over the bow and aft to the point of injury.

* The mat is kept on top the hammock netting on the port side forward, and the guys, etc., on the starboard side.

The men to shackle and attend the forward and after guys, hogging line, halliard and distance line, will be individually stationed by the officers commanding the 1st and 4th divisions, who will be responsible for a proper detail and proper knowledge of the fact by the men so detailed.

In every compartment of the ship, at least one beam has the frame number stenciled upon it; and on deck the position of every fifth frame is indicated by its number stenciled on the side of the waterways. Also, the position of every under-water sea connection is indicated in the waterways as follows: the name of the opening is stenciled on the outboard vertical side; upside down, on the inboard side, is stenciled the depth of the opening in feet below the rail, measured along the shape of the hull, so that with the corresponding mark of the distance line at the rail, the center of the mat will be at the opening.

The 2nd and 3rd divisions fall in, ready to lend a hand at the guys or where required.

If at battle stations, the siren will not be sounded; the signal for closing W. T. doors and hatches will be the springing of boarders' rattles in ammunition passages, 13-inch handling rooms and central passage of fire-rooms. As all hatches and doors outside of those parts of the ship are closed before going into action, the powder division will not have occasion to leave the ammunition passages. The only doors to be closed in those passages themselves will be the two after ones and the port forward one, so that the central station can still be occupied, and a certain amount of the ammunition supply maintained until the order is received to abandon the orlop deck, when everything will be closed and the division will form on the berth deck. The 13-inch handling room crews will close their magazine and shell-room doors, and the hatches leading to the turning engine-rooms; if called up, their escape will be through the top of the turret.

Fire Bill (Summary).

Fire forward is indicated by one stroke of the bell and one bugle blast, following the alarm; fire aft, by three strokes and three blasts. The stationing is by divisions; the powder and engineer's divisions, each in their own part, handling all lines of hose below the main deck, and the gun divisions the hose in their parts of the ship.

If the fire occurs when not under steam, the various lines of hose will be connected and led out in the same manner and by the same men as when the steam-pumps are available; the valves isolating the hand-pumps will be opened, and the combined force of all these pumps will be delivered into the fire main so as to be available in any part of the ship.

All the men of the powder division are specially stationed by watch numbers at the various doors, hatches, air-ports, air-duct valves, hoses and connections; and in closing whatever hatches must be closed, they are to be careful to search for and give warning to men in distant compartments. When there is no steam on the ship this division mans the starboard berth deck hand-pump. In the gun divisions, certain men are stationed by their watch numbers at each line of hose, and at each valve and nozzle; four men from each seaman division are detailed as smotherers and two as axemen; and others to be ready to cover hatches if ordered. Men not specially stationed fall in at their quarters and stand by to man the hand-pumps, assisted by hatch-coverers and hose-men as relief crews, each division having one hand-pump assigned to it. No line of hose will be led below the main deck without special orders.

The gunner and his mates will stand by to flood the threatened magazines and shell-rooms.

If in action, or at battle stations, the division officer nearest to the fire will detail men to attack it. No alarm will be sounded, and the fire will not be reported to the conning tower unless it threatens to assume serious proportions, or materially weakens the gun-fire of any division or the general supply of ammunition. If reported, the fact of its being gotten well under control must also be immediately reported. The officer of the powder division will immediately close any magazine or shell-room that may be threatened, and be prepared to flood them; if within the limits of his action, he will attack the fire with grenades and hose, and endeavor to isolate it by closing doors and hatches, and he will continue to serve the battery from the magazines and shell-rooms that are not threatened.

Boat Bill (Summary).

The running boats' crews are so made up of available men that when any boat is called away it will affect all parts of the ship about equally. Men on special details, such as side cleaners, mess cooks, messengers, etc., are not in running boats. Enough men are stationed in each running crew to allow for two or three vacancies; if a crew should still be short when called away, vacancies will be filled as follows:

1st Steamer is supplied	from		1st Cutter.
1st Whaleboat	"	"	1st Cutter.
1st Cutter	"	"	1st Launch.
2nd Steamer	"	"	2nd Cutter.
2nd Whaleboat	"	"	2nd Cutter.
2nd Cutter	"	"	2nd Launch.
3rd Cutter	"	"	4th Cutter.
4th Cutter	"	"	3rd Cutter.
5th Cutter	"	"	1st Cutter.

All officers and men stationed in boats at "Arm and Away" are in the same boats at "Abandon Ship," except the apothecary and a bayman, who are in the gig (hospital boat) at "Arm and Away," but in other boats at "Abandon." *

At "Arm and Away," the 1st division mans the 1st, 2nd, and 5th cutters, which hang forward in port; the 2nd division, the 2nd launch and 2nd whaleboat; the 3rd division, the 1st steamer, 1st launch and 1st whaleboat; the 4th division, the 2nd steamer, and 3rd and 4th cutters. Each division entire, and the men of the navigator's and powder divisions who are in that same part of the ship, are detailed for the boats; but the number to be carried for "Cutting Out" is prescribed for each boat, and its officer will take only that number. If called away for "Distant Service" the boat officers will take only the pulling crews. The marines embark for "Cutting Out" in the two launches and 1st and 2nd cutters. The steamers each carry a boat-gun with its crew, and no other men except for landing the battalion, on which occasion they carry the color guard, signalmen, and pioneer, commissary, ambulance and ordnance parties.

The expedition is commanded by the executive officer. The boatswain is beachmaster.

* These two exceptions, while found convenient, are not a necessity, and in making out a new bill I would do away with them, as in the bill suggested. A surgeon and one hospital apprentice are plenty for a boat expedition; and if the whole battalion were landed for active service, the ambulance party would go.

At "Abandon Ship," all the rest of the ship's company is divided among the boats so as to bring up the number in each as follows in the table below, together with the amount of provisions in each. The quantities of provisions are based approximately upon the rate of 3 pints of water, 1 lb. of bread, and 10 ozs. of meat per man per day for four days.

Boat.	Number of men.	Number and capacity of breakers.	Tins of bread.	24-lb. boxes of meat.
1st Steamer.	40	3 of 20 gals.	6	4
2nd Steamer.	40	3 of 20 gals.	6	4
1st Launch.	68	5 of 20 gals.	10	7
2nd Launch.	68	5 of 20 gals.	10	7
1st Cutter.	33	2 of 20; 1 of 10	5	3
2nd Cutter.	33	2 of 20; 1 of 10	5	3
3rd Cutter.	33	2 of 20; 1 of 10	5	3
4th Cutter.	27	2 of 20 gals.	4	3
5th Cutter.	24	2 of 20 gals.	4	3
1st Whaleboat.	23	2 of 20 gals.	4	3
2nd Whaleboat.	23	2 of 20 gals.	4	3
Gig.	16	1 of 20 gals.	2	2
1st Dinghy.	10	2 of 10 gals.	2	1
2nd Dinghy.	10	2 of 10 gals.	2	1
1st Punt.	4	1 of 10 gals.	1	1
2nd Punt.	4	1 of 10 gals.	1	1
Balsa.	7	1 of 10 gals.	1	1
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The 1st Dinghy keeps company with 1st Launch.
" 2nd Dinghy " " " 2nd Launch.
" Balsa " " " 1st Steamer.
" 1st Punt " " " 1st Cutter.
" 2nd Punt " " " 2nd Cutter.

For Landing Force, the battalion, of four companies, is conveyed to the shore as follows:

1st Company (marines) in 1st Launch.
2nd " in 2nd Launch.
3rd " in 1st and 3rd Cutters.
4th " in 2nd and 4th Cutters.
Commissary and Pioneer parties and Signalmen in 1st Steamer.
Color Guard, Ambulance and Ordnance parties in 2nd Steamer.
The 1st Steamer takes the starboard tow—odd-numbered boats.
" 2nd " " port " —even- " "

Clear Ship for Action Bill (Summary).

If awnings are spread or up, each part of the ship will furl its awnings and send them below, and the men will then join their divisions.

All other work will be performed by the divisions under the supervision of the division officers, each in the part of the ship where it is located. The powder division has jurisdiction in assigning stowage for articles struck below. Nothing shall be so stowed as to interfere with free movement about the decks, or out to the side below where it could interfere with reaching shot-holes.

The master-at-arms and main-deck mess cooks will assist the 5th division in clearing away and securing mess chests, etc., before joining their own divisions.

Storekeepers will close their W. T. doors and hatches as soon as required articles have been received or issued; and they will report the fact to the carpenter.

When clearing ship for exercise, the following variations will be observed: Exercise heads will be attached to torpedoes, and the gear set for coming to the surface; ready magazines will not be filled; all binnacles will be left in place; fires will not be lighted in boilers not in use, nor spread where banked; coal will not be trimmed down into lower bunkers; ashes will not be hoisted; steam will not be turned on main engines if not already on; flushing pumps will not be stopped.

[All the work to be done as directed in the department's Instructions is stated in detail for each division, without assigning any particular duty to any particular watch number.]

Casualty Bill (Summary).

When R. F. guns' crews are depleted in action, the crews of the corresponding guns on the unengaged side will fill the vacancies.

When one of the forward 8-inch turret crews is depleted, the crews of 6-pdr. No. 9 (on bridge deck) will fill vacancies, beginning with the one on the unengaged side; the after 8-inch turrets draw similarly from No. 17.

If the motor of a 6-pdr. ammunition hoist becomes disabled, the hand-power gear will be worked by the powder division assisted by two men on either side from the secondary battery. If the hoist breaks down, the powder division will pass the ammunition up to the berth deck through the hatch on the starboard side, and the secondary battery crews will rig and man a tackle down the hatches from the upper-deck beam.

If the 8-inch ammunition hoists become disabled, the turret crews will man the tackle.

If the 8-inch steam training gear becomes disabled, the hand gear on the orlop deck will be manned by men from the turret crews, reinforced, when necessary, by the powder division.

If the 13-inch steam training gear becomes disabled, the hand gear will be manned by the handling room crews, reinforced by men from the engine and fire rooms respectively, until further arrangements are made from the conning tower.

Six-pounder crews Nos. 9 and 17 (bridge deck) form auxiliary search-light crews.

Torpedo Defense Bill (Summary).

The 8-inch, 6-pdr., and 1-pdr. crews will be at their guns.

The 1st and 4th divisions, except the R. F. and machine guns' crews, will man the rail on the forecastle and quarter deck respectively, with rifles.

The riflemen of the 5th division will man the rail between the casemate and the 1st and 4th divisions, No. 7 guns' crew forward, No. 8 aft.

The navigator's division will man the search-lights and field guns.

The powder and engineer's divisions will close all water-tight doors and hatches.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SKETCHES FROM THE SPANISH-AMERICAN WAR.

By Commander J——.

[Translated from the Marine-Rundschau, January and February, 1899—Concluded.]

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INTRODUCTORY.

Sketches from the naval battle of Santiago and occupation of Puerto Rico, by Commander Jacobsen, of the German protected cruiser Geier, given in this number of the War Notes, are a continuation of Sketches from the Spanish-American War, by the same officer, given in War Notes No. III.

Richardson Clover,
Commander, U. S. N., Chief Intelligence Officer.

Navy Department, *March 27, 1899.*

Approved:
A. S. Crowninshield, *Rear-Admiral, U. S. N., Chief of Bureau of Navigation.*

VI. The Naval Battle of Santiago.

1. I have no official sources at my disposal from which to give an account of the battle. The reports of Admiral Sampson and the commanders of the American ships, as well as the reports on the condition of the Spanish vessels after the battle and on the positions and movements of all ships during the battle, were published in the New York Herald. From the Spanish side nothing

has been published except a short report of Admiral Cervera to Captain-General Blanco and an article entitled "Admiral Cervera's fleet," published in the Revista General de Marina. Under these circumstances it is inevitable that errors and omissions will occur in the account of the battle; but, on the whole, it will probably give an approximately correct idea.

Paragraphs 2-13, inclusive, have not been translated, as they were from the United States publications containing:

(1) Descriptions of the United States and Spanish vessels engaged in the battle.

(2) Chart showing the positions of the ships during the battle at different times between 9.30 a. m. and 1.15 p. m. from the records of the United States Naval Board appointed to plot such positions.

(3) Description of the engagement compiled from official reports of the commanders of the United States vessels.

(4) Condition of Spanish vessels after the battle, as shown by the United States board appointed to examine them.

14. With Admiral Sampson's permission the officers of the Geier inspected the Spanish ships on August 12, more than a month after the battle, at which time the following observations were made:

(*a*) The ships, after coming out of the harbor entrance on a westerly course, turned to starboard and ran ashore in small coves, where they probably saw the best chance for their crews to reach the shore through the surf.

(*b*) The reason for beaching the ships can probably be found in the fact that the fires which broke out on board after the first American hits could not be controlled by the crews, who had lost their heads under the hail of hostile projectiles. All three of the ships present pictures of the most frightful ruin, chiefly due to the explosions and the conflagrations, which did not reach their full intensity until after the ships had been run ashore. All the woodwork and combustible material had been burned. The following will give an idea of the intense heat that must have prevailed:

The iron deck beams and other horizontal iron parts were very much warped; the bearings of the connecting rods had been melted; the iron masts had been partly melted where they pass through the upper deck; the brass frames of the ports between decks had been partly melted, and the ports themselves were found on deck converted into large lumps of glass; parts of the rapid-fire mounts had been melted, the lead in the small caliber and machine-gun projectiles had melted and run out, and the casings had been reduced to ashes.

(*c*) Besides the conflagrations and subsequent explosions, the ships sustained such severe leaks when running ashore that it will be impossible to float them again, with the exception of the Maria Teresa, which is now being attempted to be hauled off.*

All the masts of the ships had fallen aft and had been hurled to the deck with their tops. Only the mainmast of the Maria Teresa was left standing, which is an evidence that she ran ashore at less speed, which is further shown by the fact that she sustained less leaks than the other ships. The mainmast of the Oquendo had fallen to starboard and broken in two upon striking the railing and one part gone overboard.

(*d*) Nothing definite could be ascertained as to the boats that had been on board. There was nothing left but the wrecks of two iron steam launches hanging in the warped and partly broken davits on board of each of the ships.

(*e*) The engines were probably intact in all of the ships at the time they ran ashore, for they were apparently running at great speed—at least the Oquendo and the Vizcaya.

The machinery installation on board the ships was about as follows:

α. The two main engines and six main boilers are located in five water-tight compartments below the protective deck. Above them, between decks, and protected by lateral coal bunkers, are two large auxiliary boilers of at least 12 tons capacity, and many auxiliary engines, conspicuous among which is a large and powerful centrifugal bilge pump with a discharge pipe of about 300 mm. diameter. The protective deck, extending from the stem to the after torpedo room, is slightly vaulted forward of the boiler rooms, and pierced above the boiler and engine rooms for the passage of smokestack casings and engine skylight, but is protected at this place by a strong glacis, rising at an angle of about 30 degrees from the inner bunker walls. The openings in the engine skylight and smokestack casings were protected by iron

* In the meantime the Maria Teresa has been floated by American wreckers, but she sank on her way to Norfolk.—Ed. Rundschau.

gratings. The protection by lateral coal bunkers extended through boiler and engine rooms, reaching to the battery deck, a height of 3.5 meters. Alongside the engine rooms in each of the bunkers to port and starboard forward and starboard aft was a room for engine supplies, while to port aft was a well-equipped workshop, extending nearly to the ship's side. In the workshop was a small 1-cylinder steam engine for driving transmission gear, actuating a turning-lathe, a boring engine, a grindstone, and very strong shears, also five vises. The supply rooms appear to have been well equipped, but everything seems to have been stored in wooden closets and on wooden shelves, for all the tools were found scattered on the floor in wild confusion.

β. There was a surprising number of rough castings, especially of stuffing boxes. Spare parts for the main engines were found suspended in the engine skylight; covers, pistons, and slide-valve faces for low-pressure cylinders on the bulkheads. To the smokestack casings were secured three connecting rods, eccentric rods, etc.

γ. Nothing could be noticed of any provisions having been made for the protection of the machinery installations except the iron gratings. In the Almirante Oquendo coal sacks were found near the auxiliary boiler, but their object could not be determined, the boiler room being flooded. The steam pipes above the protective deck do not appear to have been disconnected before the battle. Valves leading to auxiliary engines, which were not used during the fight (such as ash-hoisting machinery, pumps for auxiliary boilers, etc.), were found open. The centrifugal bilge pump above mentioned also appeared to have been in gear. The bulkhead doors above the protective deck were all open. They could not have been opened subsequently, since all the bulkheads had been warped by the heat, but the bolts were intact.

(*f*) At the time of our inspection nothing could be ascertained regarding the injuries in the engine rooms, because they were all under water almost up to the protective deck. It was learned from an American engineer engaged in the wrecking operations of the Infanta Maria Teresa that no dead bodies had been found in the engine and boiler rooms, and hence it is probable that there have been no material injuries to the boilers and steam pipes. All the bunker bulkheads and connecting doors are said to have been open and all the fires of the boilers lighted.

(*g*) The damages above the protective deck had been caused chiefly by the conflagrations, but also by hits from the enemy's secondary battery. The inadequacy of the lateral protection of the engine rooms was striking. The supply rooms and workshops had been hit a number of times. Shots which entered the coal did not go through. Only one hit was noticed in the auxiliary piping above the protective deck of the Infanta Maria Teresa. The shot had gone clear through the pipe without ripping it open, from which it may be inferred that there was no steam in it at the time.

(*h*) On the gun and upper decks the smokestack casings had been perforated in several places, also the smokestacks themselves. Apparently no measures had been taken for closing up these shot holes. The electric wiring had been struck in many places. Shot holes were also noticeable in the speaking tubes. It was not possible, owing to the complete destruction by fire, to make any further investigation of the means of communication and command.

(*i*) The three ships inspected had all their guns on board. The only ones that could not be found were the two 7-centimeter rapid-fire boat guns, but pivots had been provided on both sides of the stern, where these two guns were apparently intended to be installed for use against torpedo-boat attacks at night.

(*k*) From the slight losses which the American ships claim to have sustained, it may be judged that the training of the Spanish gun crews must have been very inadequate. This is not surprising, in view of the statement of one of the Spanish naval officers to the effect that no target practice is held in Spain in time of peace. Other circumstances also give evidence of very inefficient handling of the guns. The turrets and their guns, with the exception of the forward turret of the Almirante Oquendo, were found entirely intact. The loading apparatus for the 28-centimeter guns (Whitworth, Manchester, 1895) was of the hydraulic order, and the loading time was about two minutes. The 14-centimeter rapid-fire guns also were probably not used to their best advantage, owing to want of experience. There was evidently no lack of ammunition, for near some of the guns a number of cartridges were found, and some of the guns were still loaded, but had not been fired. To what circumstance it is due that the breech-blocks of two of the guns were found lying in the rear of the guns with their pivot bolts torn off, could not be explained. Perhaps this may also be attributed to inefficient handling of the projectiles.

(*l*) Only the port side of the ships was fired upon. The starboard side shows but a few holes, where shots have passed out. Where the course of projectiles could be traced, it was usually ranging from port aft to starboard forward. The destructive effect of the American projectiles is mainly due to the conflagrations caused by them. Aside from a shot through one of the turret roofs, no hits were observed in any of the armored turrets. Neither have any projectiles pierced the side armor, which shows no injuries. Only indentations are noticeable in places where projectiles have struck the armor. Projectiles of 15 centimeters and larger calibers that had hit the ship had in many instances gone out through the other side, making holes about 1 meter square, but without bursting. As the same observation has been made in the bombardments of Santiago and San Juan, it may be assumed that it is due to the uncertain functioning of the base fuse. It is not probable that the Americans used armor-piercing shell, as fragments of projectiles of different sizes found in the vicinity show that explosive shell and not nonexplosive shell were used. Projectiles which had hit smokestacks and masts had gone clear through, making only small, round or oblong shot holes. Hits of small-caliber projectiles (5.7-centimeter) could be noticed in large numbers, and this was corroborated by the statement of an American officer to the effect that they were used in great quantities.

(*m*) The question whether the Spanish had any intention of making use of the torpedo weapon may probably be answered in the negative. The torpedo armaments of the ships, although including a large number of tubes, were so defective that there could hardly be any chance of success as against the powerful American ships. The armaments consisted of two bow, four broadside, and two stern tubes, all above water and of antiquated design, with large cartridges, band-brakes, etc., all located above the armored deck and entirely unprotected. In a very primitive manner the tubes had been partly protected by grate bars lashed with chains.

(*n*) The projectiles were 35-centimeter Schwartzkopff torpedoes with large depth-regulating apparatus.

No war-heads were to be found, with a single exception. According to the statement of an American petty officer, the war-heads had been left at Santiago, where they were to be used in connection with the mine obstructions. It is true that this does not agree with the fact that a torpedo head exploded on board the Almirante Oquendo. It is possible, however, that the ships retained one or two war-heads to be used in case of necessity as against rams, since the broadside tubes were adapted to be turned in any direction, or perhaps it was the commander's wish to take a war-head along.

(*o*) The following points support the assumption that it was not the intention to make use of the torpedo weapon:

α. Not one of the tubes still in existence was loaded, and all the tubes were closed. In the tubes destroyed by shots or otherwise no remnants of torpedoes were found.

β. The remaining torpedoes, almost without exception, were lying in their places along the ship's side. No torpedoes were found lying back of the tubes, with the exception of the bow tubes of the Almirante Oquendo.

γ. There was no pressure in any of the flasks. This is shown by the fact that the flasks were entirely uninjured, although the heat had partly melted the tailpieces of the torpedoes.

δ. In several of the torpedoes lying on top, the protecting cap for the depth-regulating apparatus had not been taken off, while it is necessary to remove it in order to put on the war-heads.

ε. In a few of the torpedoes the sinking valves had been put in place, but in most of them they were still found soldered, with connecting links raised.

ζ. The tubes for filling the launching cartridges were not connected and only on the Almirante Oquendo was the powder charge in readiness.

A. Infanta Maria Teresa.

(*p*) This was the flagship, and the first one to be beached, about 6 miles from the entrance of Santiago. The ship's bow was lying only a little higher than usual above the water-line, the stern a little lower; otherwise upright. She evidently ran ashore at slow speed, for aside from the fact that there were only small leakages in the bottom, no boiler explosion took place, nor was the mainmast thrown down. In other respects also her injuries are much less than those of the other ships. The ammunition rooms appear to have been previously flooded, and therefore did not explode.

(*q*) This ship shows very few hits from the hostile guns, especially few of small caliber as compared with the others. While all the woodwork has been burned, the same as on the other ships, little damage has been sustained by the ship's hull. The ship has therefore been floated by the Americans.* All leaks had been stopped up, the ship pumped out, and then hauled off by steam tugs about 6 feet toward the sea. In this operation she sprang another leak aft and was again filled with water. On the day of our inspection this leak was being stopped up and the water pumped out by means of four steam pumps. Heavy articles, such as anchors, chains, etc., had been transferred to one of the wrecking steamers. While the ship was dry the two forward boilers had been set to work, and with them the auxiliary piping and several bilge pumps. One of the workmen stated that the engines had been found intact. The engine rooms could not be visited, because they were under water up to the tops of the cylinders. It could only be ascertained that the engine skylight had not been damaged.

(*r*) Three hits of large caliber—probably 20-centimeter—were observed:

α. A shell had entered the after torpedo room close above the water-line, had passed through a heavy stanchion and a lateral bulkhead, and out through the starboard side, where it had torn a hole about 1 meter square. There were no indications to show that the projectile had burst. The shot hole on the starboard side was slightly forward of and about 1 meter higher than that on the port side.

β. Another projectile had passed through the whole length of the compartment above this torpedo room and out through the starboard side, likewise without exploding.

γ. A heavy shell must have exploded at the upper conning bridge, for the top of the conning tower, without having been perforated, showed large oblong scars, caused by heavy explosive fragments.

(*s*) A 15-centimeter shell had struck the port bow and loosened

* She sank again on her way to the United States.—Ed. Rundschau.

he re-enforcement ring of the hawse hole. No injuries from explosive fragments were noticed here.

Another 15-centimeter shell had perforated the 3-centimeter shield of a 14-centimeter rapid-fire gun on the port side. Fragments had destroyed the shaft of the elevating gear and both hand wheels. Others had perforated the forward smokestack casing. This hit appears to have annihilated the whole crew of this gun, near which six charred bodies were found.

Another 15-centimeter shell had damaged the after smokestack, after passing through the empty part of a coal bunker, which was still filled with coal to within 1 meter of the ceiling.

(*t*) Very few small-caliber hits were noticed, only 6 in the ship's sides, 2 in the forward, and 5 in the after smokestack, though one of the latter may perhaps have been caused by a 15-centimeter projectile. Near the stern three indentations were noticeable in the side armor, probably caused by 5.7-centimeter projectiles which, striking at a very small angle, had glanced off.

(*u*) Further observations made are as follows:

All the breech-blocks of the rapid-fire guns and parts of the mechanism of the revolving guns had been thrown overboard by the Spaniards. Whether the turret guns had also been rendered unserviceable could not be ascertained. In any event, they had not been injured by hostile projectiles nor by the conflagrations. The gun sights were also missing. Inside the armored turrets no damages of any kind were noticeable. Even the paint had hardly suffered from the heat. In the after-turret gun a projectile had been rammed home, but apparently the cartridge had not been entered. The conning tower was not injured, only burned on the inside.

(*v*) The torpedo-launching tubes and torpedoes had been less damaged by shots and fire than in the other ships. The complete remnants of twenty-four torpedoes were found, with the exception of the war-heads. Only a few practice heads were found.

B. Almirante Oquendo.

(*w*) This ship sustained very severe leaks when running aground. She lies over to port, with the bow about 1 meter light and the stern 1½ meters deep. The ship appeared to have her back broken in the region of the foremast. The rapid-fire ammunition room just forward of the after turret had exploded.

Amidships everything above this room had been hurled down. The protective deck was heaved up and wrenched from the sides. The deck beams throughout were badly warped, and both sides of the ship showed large holes, through which the water was washing in. The second explosion had taken place in the forward rapid-fire ammunition room. The effects were about the same as aft. On one side they were still further increased by the explosion of a torpedo war-head in the forward broadside torpedo room. Here the aperture in the ship's side had reached the dimensions of two meters in width and about 5 meters in length, its lower edge being formed by the armor.

(x) The Almirante Oquendo had suffered more than either of the other ships from hostile projectiles.

α. A 15 to 20-centimeter shell had torn a piece about 20 centimeters wide and 50 centimeters long from the upper edge of the gun port in the top of the forward 28-centimeter turret and burst inside. A number of small holes, caused by shell fragments, covering a space of about 1 meter square, were noticeable in the top of the turret. There were no other traces of shell fragments. The bore was empty, the breech-block closed, and a shell was found in the rear of the gun in position for loading. Back of the gun and to the left of it two charred bodies were found, and to the right a mass of human remains that had apparently formed two more bodies. A head was found lying on the platform under the gun. Where the turret commander had been standing another charred body was found lying on its back, with the gun sights under it. The gun itself appeared to have sustained no injuries.

β. A shell, probably of 20-centimeter caliber, had passed through the ship's side in the engine workshop, where it had demolished the transmission shaft, the boring engine, and the turning lathe; then through the engine skylight and exploded on the other side of the latter, in the engine supply room.

γ. A heavy projectile had passed through the smokestack and out through the starboard side without having burst in the ship.

δ. About 25 meters from the stern a heavy shell had struck the 'tween-decks and passed through it. On the starboard side inboard, several small holes were visible, apparently from fragments of this shell.

ε. A shell, probably of 15-centimeter caliber, had hit the shield of the fourth 14-centimeter rapid-fire gun. The irregular holes noticeable in the forward smokestacks are probably attributable to fragments of this shell. The wheels of the revolving and elevating gear of this gun had also been damaged.

ζ. A 15-centimeter shell had passed through the port coal bunker and out through the starboard bunker.

η. A 14-centimeter rapid-fire gun on the starboard side had been hit on the left side by a 5.7-centimeter shell ranging forward. The projectile with solid point had passed entirely through the forward hoop and penetrated the bore to the depth of 2 centimeters. There were no splinters from the gun, but the displaced metal had been forced out at the edges, which is a proof of its great tenacity. The point of the projectile had been broken off and was lying near the gun. The hole is about 15 centimeters long and at the widest place 5 centimeters wide.

θ. In the whole port side about forty small-caliber hits were counted, most of them amidships. The smokestacks had also been hit several times by small projectiles.

ι. Other observations made on board the Almirante Oquendo are as follows:

The armor had not been injured by any hits. In two of the rapid-fire guns the sights were found set for ranges of 13 and 14 kilometers, and in the 5.7-centimeter after-port gun at 10 kilometers. The sights of all the guns, with the exception of the revolving guns, had traveling eyepieces. None of the sights were found set for short ranges. Some of the 14-centimeter rapid-fire breech-blocks were missing, while some of the guns were found completely loaded.

(y) The torpedo tube in which a torpedo had exploded had been torn into small fragments, the largest of which were a guiding bar and a hinged door. The torpedoes secured to the ship's side had also been destroyed, with the exception of the flasks, which had been hurled several meters from their positions. The bulkhead 'tween-decks near the place of the explosion showed traces of the same. Pieces about 4 centimeters square had passed entirely through it, while still smaller pieces had penetrated it to the depth of several millimeters. The conning tower had remained intact.

In the forward torpedo room torpedoes were found near each of the tubes, but without war-heads on them. The port tube had the depth-regulating apparatus in readiness. The outer cap of one of the tubes was still open. The tubes had been bent by the grounding of the ship. They were not loaded.

c. Vizcaya.

(*z*) The Vizcaya, like the Almirante Oquendo, is so seriously damaged that there is no prospect of hauling her off. This ship also ran ashore at great speed, and the keel was apparently broken in two, for with each sea the stern would rise and fall with loud creaking and groaning. The vessel was lying almost upright with only a small list to port. All the rooms below the protective deck, and the after rooms above it, were flooded.

Near the forward turret an explosion had taken place in the lower part of the ship, probably in one of the ammunition rooms. The wooden part of the upper deck had been burned and the iron plating torn open, and through the gap could be seen a chaos of broken anchor gear, capstans, chains, cement, rubbish, torpedo tubes, etc. The hull is about equally damaged on both sides.

α. The protective deck had been ripped open and the plating folded back on the starboard side, between the forward smoke-stack and the ship's side, probably as the result of a boiler explosion. The pivot sockets of the 14-centimeter rapid-fire guns had been torn away and the guns bent back to such an extent that the bores were pointing upward almost vertically.

β. Hot coal gas and smoke issuing from an open bunker hole showed that the coal was still burning.

γ. The Vizcaya had suffered little from hostile fire. A 15 to 20-centimeter shell had struck the forward broadside torpedo room, dismounted the port tube, and had apparently killed a number of men. Several charred bodies were found scattered over the whole room.

A 20-centimeter shell, ranging forward, had passed through the ship's side, through a locker amidships near the second 14-centimeter rapid-fire gun, and through a lateral bulkhead abaft of the forward turret; then, striking the turret, had glanced off without causing any impression, and exploded on the starboard side.

A heavy shell had entered the gun deck forward of the after turret and passed out through the starboard side without bursting in the ship.

Besides these three large-caliber hits, about twelve smaller ones ould be noticed in the broadside, most of them of 4.7 and 5.7-centimeter caliber; also five hits in the forward and one in the after mokestack.

Other observations were made as follows:

The conning tower had not been damaged by projectiles, but completely burnt out on the inside. The conning bridge was otally demolished. Two charred bodies were found still lying in the tower, also several bodies or parts of bodies in different places on the iron gun deck. Many rapid-fire cartridges, either whole or in part, were found scattered about; also a quantity of exploded small-arm ammunition.

The breech-blocks of two 14-centimeter rapid-fire guns were found near the guns. In one of these guns the projectile had been jammed near the muzzle. The whole cartridge was found in one of the bores. The breech was open.

δ. The torpedoes had not been made ready for use and the tubes were not loaded.

15. If we compare the observations made by the officers of the Geier as to the number of hits with the results of the examination made immediately after the battle, we obtain the following figures:

Hits from—	Maria Teresa.	Oquendo.	Vizcaya.	Colon.
10-cm. projectile	1	5	2	....
12.7-cm. projectile	5 IV	5 III	6	4
20-cm. projectile	3 } III	3 IV	4 III	....
30.5 / 33 cm. projectile	2 }	....	....	....
Secondary battery	20 XV	42 XL	11 XVIII	....

In the above table the Arabic figures designate the results of the United States Board, while the Roman figures represent the observations made at the time of our inspection in August last. It will be noticed that there is not much discrepancy in the figures. Of course, observations made so long after the action can not lay claim to absolute accuracy, especially as our sojourn on board was necessarily short. The traces of many hits have been partly obliterated by the powerful action of the surf, especially in the superstructures, of which hardly anything is left standing. It may therefore be inferred that the figures of the United States Board are more nearly correct than ours; but even they probably fall short of the actual results.

16. The Brooklyn was hit about twenty times by shells and several times by fragments and machine-gun projectiles. The cruiser sustained no serious injuries of any kind. The Iowa is said to have been hit twice in the bow, just above the water-line by 15-centimeter shells and seven times by small-caliber projectiles. The Texas and Indiana were hit twice by light projectiles without sustaining serious injuries.

17. In order to be able to realize the complete defeat of the Spanish fleet it is necessary to call clearly to mind its situation in Santiago harbor. Cervera had entered the harbor on May 19. As early as May 27 five hostile cruisers with several gunboats and auxiliary cruisers were observed in front of the harbor, and there was no longer any doubt that the whole American battle fleet was blockading the harbor. Then followed the bombardments of Morro Castle and the Socapa, several shells falling into the bay, and the Spanish ships retreated closer to the city. On June 3 the Merrimac was sunk, but the entrance remained unobstructed. On June 22 occurred the landing of the American troops, who on July 1 attacked the fortifications of the city. Five hundred men of the landing corps of the Spanish ships took part in the defense and are said to have fought very valiantly.

18. The government authorities at Havana were very anxious to have the fleet leave the harbor, in order to remove the main object of the attack upon Santiago; for the ships had been the cause of the blockade and of the attack on the unprepared city. Hence it was imperative that the ships should leave. It is probable that ever since the middle of June this had been suggested to Admiral Cervera by the authorities at Havana; but the Admiral appears to have declared that it was impossible to make an attempt to run the blockade at night. Whether direct orders were finally given to leave the harbor under all circumstances I have not been able to ascertain.

19. Admiral Cervera was in a very difficult position. He was expected to act in some manner. He did not dare make the attempt at night, and so he decided to go out with his fleet in broad daylight. The whole crew fell a victim to this fatal decision. Instructions for the order of the sortie and the taking of the western course had been previously issued by the chief of the fleet. According to the Revista General de Marina, Vol. XI, No. 3, August, 1898, the Admiral was entirely convinced of the impos-

sibility of defeating the enemy or of reaching another Cuban harbor, even if he should succeed in steaming right through the hostile fleet. It is to this feeling of helplessness and impotence as against the American naval forces more than to anything else that I attribute the defeat. The Spanish ships had spent a month and a half in the harbor without even attempting to attack the blockading fleet when a favorable opportunity presented itself, or even of harassing it. The two torpedo-boat destroyers were not used for the purpose for which they were intended. This inactivity and lack of initiative must have had a very demoralizing effect on the officers and men. If we add to this the certain knowledge that the opposing forces were much stronger, it will be readily understood that the idea of general flight after coming out of the harbor entrance was the only acceptable one, especially in view of the possibility of beaching the ships, thereby rendering them unserviceable, and eventually rescuing the crews. From the very moment that this feeling of impotence took possession of the Spanish and led to the above reflections their fate, psychologically speaking, was sealed. We do not mean to disparage their valor and tenacity in the midst of the hostile fire; but, on the other hand, it is quite natural that the Admiral, seeing that everything was happening as he had foreseen, was the one who set the example of running his ship ashore. All the other commanders followed this example.

20. On the American side the situation was just the reverse. Admiral Sampson's fleet was fully conscious of its power. The blockade was being conducted in accordance with carefully prepared plans, as were also the arrangements in case of the enemy's attempt to escape. Frequent engagements with the Spanish forts had given commanders and crews that calm and assurance in the handling of their weapons which guarantees success. The long blockade service, exhausting and monotonous, hardly interrupted by any action on the part of the Spanish, had strung the nerves to the highest pitch, and everybody was anxious for the end to come. Suddenly the enemy attempts to escape. All the passions that had been smoldering under the ashes break forth. The welcome opportunity for settling accounts with the enemy had come at last, and with a wild rush the American ships fell upon their victims. At the beginning the American fire, owing to the excitement of the personnel and the great distances, was probably

not very effective; but when the Spanish Admiral turned to westward and the other ships followed him the moral superiority of the Americans reasserted itself. The commanders, calm and cool-headed, had their ships follow the same course, and the Americans, having every advantage on their side, recommenced the fire on the fleeing ships, which soon resulted in their total annihilation.

21. I have already spoken of the lack of training of the Spanish crews, the neglect of gun and torpedo target practice, the inadequate education of the commanders of the ships and torpedo-boat destroyers. It is mainly due to these deficiencies that the defeat was hastened and that the American ships sustained so few losses. Furthermore, there can be no excuse for having allowed the cruiser Cristobal Colon to leave Spain without her heavy armament. It has also been stated that the rapid-fire guns of this cruiser were unserviceable, so that she was really completely defenseless. The training of the engine personnel also was totally unreliable, which is not surprising in view of the fact that the Spanish ships, as a rule, are not sent out on extensive cruises. The bottoms of the Spanish ships had not been cleaned for a long time, and as they had been lying in Santiago Harbor for a month and a half they were considerably fouled. Thus the cruisers Maria Teresa, Oquendo, and Vizcaya, which in all official books are credited with 18.5 knots speed, went into the battle with a speed of from 10 to 12 knots at most, and the Cristobal Colon, which is the latest ship and was to run 20 knots, hardly attained a speed of 13.5 knots. Under these circumstances, in every way unfavorable for the Spanish, whose crews were insufficiently trained and physically and morally enervated by long inactivity, whose ships were inferior in number, speed, and fighting efficiency, it is no wonder that the victory of the Americans was easy and paid for with insignificant sacrifices.

22. There was only one chance for the success of the sortie. It should have been made at night in scattered formation. After a personal investigation of the locality, it is my opinion that it is entirely practicable for a fleet to leave Santiago harbor at night. The wreck of the Merrimac did not constitute an obstruction. It is true that Admiral Sampson's report on the night blockade states that the light-ships were lying from 1 to 2 miles from Morro Castle, according to the state of the atmosphere, and that

hey lighted up the channel for half a mile inside. Even the best earch-light, however, does not reach farther than 1 mile. Thereore the illumination could not have been very effective. Moreover, the shore batteries, by opening fire upon the light-ships, could have compelled them to change their positions; but, strange o say, this was never done. The dark nights at the time of the new moon about the middle of June would have been best suited or the enterprise. Besides the four vessels of the fleet, two large Spanish merchant vessels lying in Santiago harbor might have been taken out in order to deceive the enemy. The six vessels, with lights darkened, should have followed each other out of the harbor entrance, in predetermined order, as fast as possible. They should then have steered different courses, previously determined, with orders not to fight except when compelled to do so by the mmediate vicinity of a hostile ship or when there was no possiility of escaping the enemy in the darkness. A rendezvous should have been fixed for the next day, where the ships that ucceeded in escaping were to assemble.

23. If the fleet did not dare attempt a night sortie and was nevertheless compelled to leave the harbor in obedience to orders, then the ships should have been headed straight at the enemy. All weapons, including the torpedo and the ram, should have been used. A bold attack in close formation was the only chance of success against the superior hostile fighting forces, who would hardly have found time to form their lines.

24. I shall not attempt to discuss at length all the lessons which may be derived from the battle, because this would lead too far. I will only enumerate them, and confine myself to dwelling a ittle more fully on those which are of the greatest importance for practical service.

(*a*) Abolition of all woodwork.

(*b*) No unprotected torpedo tubes.

(*c*) Protection for all gun crews against shell fire.

(*d*) Protection of the fire-extinguishing apparatus against shell ire.

(*e*) Smokeless powder; greatest possible simplicity in the serice of the guns and greatest possible rapidity of fire.

(*f*) Good speed of the ships under normal conditions.

(*g*) Thorough training of the crews in all branches of the serice.

25. The last two are the most important. A ship may show very brilliant results at the trial trip and be credited with the greatest speed in the different books on the navies of all nations; but for the officer who is to command the ship in battle this is not a criterion from which to judge of her efficiency. Frequent trial trips under full steam, making it possible to discover and cure defects of the machinery in time of peace, and familiarizing the personnel with the functioning of the vessel in all its details, can alone give the commander an idea of what he may expect of his ship in battle. Extensive cruises at war speed should also be made, in order that the personnel may get an idea of how much more will be required in time of war. This is especially important in the tropics, where the great heat materially affects the physical endurance and efficiency of the boiler and engine personnel.

26. The most perfect training of the crews in all branches of the service, especially by all kinds of torpedo and gun practice, as nearly as possible under war conditions, is the foundation of success. As I said in Part IV of this work, nothing should be left undone to attain the greatest perfection possible in time of peace. No expense should be spared to enable those who bear the responsibility of the battle—the chiefs of fleets and squadrons, as well as all commanders—thoroughly to test the actual degree of efficiency of their crews by practical exercises, resembling as nearly as possible the operations of actual warfare.

27. Such exercises will also demonstrate whether the weapons, from a technical standpoint, are equal to all the exigencies of war. I learned, for instance, that the following defects were found to exist in the American artillery matériel:

(*a*) *Brooklyn.*—In the 5.7-centimeter rapid-fire guns cartridges were jammed in several instances. In the 20-centimeter guns the plugs stuck several times. Some of the 12.7-centimeter rapid-fire guns became unserviceable toward the end of the battle because the elevating gear did not function properly, and all these guns had to be supplied with new mounts after the battle.

(*b*) *Texas.*—The two 30.5-centimeter guns had been fired several times across the deck, considerably damaging the latter. A suggestion made in time of peace that the guns be tested in that respect had not been followed out.

(*c*) *Iowa.*—On this ship, also, the deck had been damaged by

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the firing of the heavy guns. The training gear of the 20-centimeter guns had not been able to sustain the firing at great elevation.

The most careful examination of the artillery matériel in time of peace is absolutely necessary. Even when the strictest requirements are made and fulfilled in testing the guns, it is no guarantee that the matériel will not in the course of time show defects on board ship. In order that such defects may not remain hidden, to become apparent only when the guns are used in actual war, at least part of the target practice should be held with full service charges.

VII. The Occupation of Puerto Rico.

1. In my first visit to San Juan de Puerto Rico (see Part III of the Sketches), I found there, to my great astonishment, a comparatively large German colony. I learned that in all the principal towns on the island, such as Ponce, Mayaguez, Aguadilla, and Arecibo, Germans are likewise settled, and in the possession of large business houses, enjoy the esteem of the Spaniards as well as of the Puerto Ricans. Under these circumstances it appeared necessary to send thither a warship for the protection of the Germans when the Government of the United States commenced action against Puerto Rico. I have successively visited the harbors of Mayaguez, Ponce, and San Juan. The first two were already occupied by the Americans, while the third city was still in the hands of the Spaniards. On the 13th of August it became known that peace negotiations had commenced, and hostilities ceased.

No great battles were fought in this campaign; only a few minor skirmishes took place. But the American troops were marched up in such a simple and skillful manner that the operations are not without interest. Moreover, our readers will be glad to learn some particulars about this beautiful island, in which these many years German merchants, mostly from Hamburg and Bremen, have exerted their best energy in steady, unremitting toil, and which now, as the price of victory, falls into the lap of the United States.

2. The accompanying map of the island is the latest and best published. It shows the different departments, so that a descrip-

tion is not necessary. All the turnpikes and roads which are to be considered in connection with the advance of the American troops, as well as the railroad skirting the coast, are also indicated on the map. The mountain range which extends nearly parallel to the southern coast from Adjuntas to Cayey is, on an average, not over 1000 meters high, and from both towns is continued in several spurs to the eastward and westward. This range constitutes a weather barrier, as the fresh northeast trades cool the northern part of the island and provide abundant rains, while in the southern part of the island the mountains prevent this moderation, and the heat often becomes unbearable. Numerous streams water the fertile soil, which in former years produced mainly sugar, but now also coffee, tobacco, and bananas, and furnish large areas of magnificent pastures. The number of inhabitants in round numbers is 800,000. The area of Puerto Rico is about one-tenth that of Cuba, which has hardly 1,500,000 inhabitants. The whole island of Puerto Rico is inhabited. There are no extensive uncultivated stretches, as in Cuba. Still, much remains to be done to obtain better yields than heretofore from the rich and fertile soil. In the first place the agricultural methods should be improved, better communication established with the coast, and, finally, the mineral treasures of the island exploited. In this latter direction hardly anything has been done. As far as the social conditions of the island are concerned, it has been spared the serious disorders that have been raging in Cuba during the last few decades. The Spanish, by means of military posts distributed all over the island, and especially the Guardia Civil, an excellent police system, have succeeded in maintaining order and safety throughout the country. There have been minor disturbances, it is true; but at no time has there been an actual rebellion against the Spanish Government, such as was spoken of at the beginning of the Spanish-American war. Nevertheless, there has gradually developed among the Puerto Ricans an intense hatred toward the selfish Spanish administration, and with open arms they received the Americans who came as liberators from the Spanish yoke.

3. The general opinion, reinforced by the United States press, was that the troops would land east of San Juan, probably at Tajardo. General Miles was the only one who was informed as to the landing place selected, and he left Guantanamo on July

21, with the auxiliary cruiser Yale and seven transports with about 3500 men. The battleship Massachusetts, the cruiser Columbia, and six small gunboats and auxiliary cruisers, among them the Dixie, Annapolis, and Gloucester, accompanied the transport fleet. Upon reaching Mona Passage the fleet headed for the southern coast of Puerto Rico, and on July 25 the troops were landed at Guanica without encountering serious resistance. The very next day, after a short fight with the Spanish, Yauco, which controls the railway to Ponce, was occupied.

On July 27 the Dixie, Annapolis, and several other vessels appeared in front of Ponce and demanded the surrender of the city. The United States general granted time until the next morning, and told the commander of the city that unless the surrender had taken place by that time he should at once proceed to bombard the city, and land his men. Captain-General Macias, at San Juan, had given the commander strict orders to defend the city to the utmost, but the combined efforts of the foreign consuls prevailed upon Colonel San Martin to agree to the surrender of the city on condition that the Spanish troops would not be pursued for forty-eight hours. This agreement, however, of which the United States commander had already been notified, was declared null and void by Captain-General Macias, who at the same time discharged Colonel San Martin from office, and it was only due to the energetic efforts of the German and British consuls that the captain-general became convinced of the necessity of surrendering, and finally consented to the evacuation of the city. Thus the Americans took possession of Ponce at 6 a. m. on July 28, without loss of life or injury to property, and on July 29 they landed a large division of troops, consisting of from 5000 to 6000 men, with artillery and wagons. On August 1 two vessels occupied Arroyo, where about 3000 men were landed.

4. Thus the Americans in a short space of time had gained possession of the three principal harbors on the southern coast of Puerto Rico without firing a single shot. They owe this, first of all, to the friendly disposition of the population and the lack of energy of the Spanish officers, who did not dare offer any resistance. General Miles's subsequent plan of campaign is self-evident. The troops landed at Arroyo were to advance upon Guayama, thence to Cayey, which lies on the main road to San Juan. The fighting forces at Ponce were also to advance upon Cayey

by way of Juana Diaz, Coamo, and Aibonito. The troops at Guanica were to advance by way of Yauco, San German, and Hormigueros, and occupy first Mayaguez, then Aguadilla and Arecibo. A glance at the map will show that this plan would compel the Spanish forces, in order not to be cut off, to retreat to San Juan. When all the United States forces had been concentrated at San Juan, they were to surround the city, supported by the blockading fleet, and it was here that the decisive blow was to fall.

5. General Miles's plan of campaign was carried out as intended. On August 8 General Schwan advanced from Yauco upon San German. At Hormigueros they were opposed by the Spanish, who with 1000 men occupied an excellent position; but as soon as the American artillery was lined up and the American lines advanced the Spanish evacuated the heights and retreated. On August 11 General Schwan took possession of the town of Mayaguez, which had been evacuated by the Spanish, and met with a hearty reception from the inhabitants. The American troops pursued the Spanish and succeeded in surprising them on August 12 at Las Marias. The Spanish troops were resting, without any special measures of precaution, on the bank of the Guasio River, when the Americans were discerned on the heights. As the river was very high from recent heavy rains, the Spanish had difficulty in crossing it. The American commander demanded their surrender; but it seems that the Spanish had opened fire, thereby compelling the Americans to answer with their artillery. This caused great confusion in the Spanish lines. Two companies only succeeded in crossing the river, the others had to surrender. The Spanish had 40 killed and wounded. Among the many prisoners who were taken to Mayaguez were several colonels and captains.

On August 4 the main body of the troops advanced on the excellent road from Juana Diaz, a small town about 25 kilometers from Ponce. On August 9 they took Coamo, which the Spanish were holding with a force of about 1000 men. The fight lasted five hours, and ended in the evacuation by the Spanish, as the Americans had succeeded in going around the enemy's flank. The Spanish had 15 killed, among them the commander-in-chief and several officers. About 150 were taken prisoners. The Americans had 7 wounded. The Spanish retreated to Aibonito, where they intrenched themselves in a fortified position. They were not effectively attacked here, because hostilities were suspended about that time.

The third division of the American troops had advanced from Arroyo and taken Guayama on August 5. On August 8, while advancing toward Cayey, the Americans had a slight engagement with the enemy intrenched in a fortified position, ending in the retreat of the latter. But the American troops had to return to Guayama, because they did not consider themselves strong enough to accomplish the task set them—viz., to advance as far as Cayey. When, on August 12, the Americans started a second time, they found the Spanish in the same fortified position. No fight took place, because the news arrived that peace negotiations had been entered into.

6. According to the census of January 1, 1898, the Spanish had the following troops in the different departments:

ARMY.

	Generals.	Commanders.	Officers.	Men.	Total.
San Juan	2	39	136	2,217	2,394
Arecibo	....	1	15	253	269
Aguadilla	....	2	13	313	328
Mayaguez	....	3	51	1,101	1,155
Ponce	....	5	51	1,317	1,373
Guayama	....	4	44	997	1,045
Numacao	....	1	16	320	337
Vieques	....	1	4	96	101
Total	2	56	330	6,614	7,002

NAVY.

	Admirals.	Commanders.	Officers.	Sailors, mechanics and firemen.	Marine infantry.	Total.
San Juan	1	9	20	287	22	339
Arecibo	....	....	1	3	....	4
Aguadilla	....	....	1	2	....	3
Mayaguez	....	1	....	4	....	5
Ponce	....	1	....	5	....	6
Guayama	....	....	1	2	....	3
Numacao	....	....	2	4	....	6
Vieques	....	....	1	1	....	2
Total	1	11	26	308	22	368

The volunteers have not been included, because, with very few exceptions, they laid down their arms as soon as the Americans landed in Puerto Rico.

7. In Puerto Rico, as well as in Cuba, no plans had been made for concentrating the troops at the beginning of the war. The fighting forces were so small that landings of the enemy at any point on the coast could not be impeded. The troops, by remaining in their different departments, might find themselves under the necessity of having to fight far superior hostile forces, and finally to retreat within sight of the enemy in order not to be cut off. The best plan would have been to concentrate all the troops in a fortified position near Cayey, keeping up retrograde communication with San Juan. If the enemy had landed east or west of San Juan, it would have been easy, in view of the good road, to effect a change of front or for the whole force to retreat to San Juan, which was the most important point of the Spanish. If that city had been defended by 7000 men, it could have resisted the enemy for a long time. It is true, however, that without the prospect of assistance from the navy, the final surrender of the city, as the result either of the harbor being forced by the enemy or of starvation, would have been only a question of time.

8. At the time of our arrival at Mayaguez hostilities had just been suspended. General Schwan had taken charge of the administration of the department. The inhabitants were entirely satisfied with the new order of things, but many families were mourning the fatal defeat of the Spanish troops at Las Marias. The prisoners taken by the Americans had been quartered in the barracks and were being strictly guarded. We had to abandon our attempt to inspect the scene of the battle because the road, owing to the recent rains, was in very bad condition and obstructed by the numerous baggage carts of the American troops. But in order to gain at least an idea of the immediate surroundings of Mayaguez, I drove to Hormigueros, where the first engagement had taken place between American and Spanish troops. A well-kept road follows the coast over almost level ground, passing through several small hamlets. Soon the scenery changes. Cane fields resplendent in their fresh verdure are seen in every direction, and beautiful hills closely covered with banana palms and coffee trees appear before our eyes and gradually rise higher and higher.

In the distance the river may be seen, crossed by a number of iron bridges, over which the railroad passes that runs along the river. The road rises very gradually, and after we had passed over the top of the range of hills we saw at our feet the pretty town of Hormigueros. At its highest point stands the church, from which one must gain a magnificent view over the whole region. We went there, and after mounting the stone steps into the belfry, we saw before our eyes a panorama of indescribable loveliness. Indeed, a better point could hardly be found from which to gain an idea of the exquisite beauty of Puerto Rico. Far as the eye can see stretch the picturesque ranges of hills clad in the loveliest green; at their feet a few scattered cottages and small hamlets, and glistening streams winding their way through them. But we could not allow our eyes to be completely captivated by the natural charms of the country. We had also to satisfy our military curiosity. One thing became evident at a glance, namely, that the church was the best tactical point of the whole region, as all the different positions could be observed from there. The Spanish commander-in-chief appears to have realized this circumstance; for, as the kindly priest of the church told us, it had been his intention to occupy the church and line up his artillery on the adjoining hill; but the priest had succeeded in dissuading the commander from this plan, which would surely have entailed the destruction of the church and town. Probably no serious resistance had been planned by the Spanish, and they were therefore only occupying the range of hills between which a defile leads to the town of Mayaguez, to which the troops retreated as soon as the Americans commenced to advance after the first few volleys. In the little town of Hormigueros peace and quite were reigning. The Americans had already appointed a mayor. A few families from Mayaguez had come hither to await further developments. On my return to Mayaguez I had an opportunity of inspecting a company of United States volunteers. They were nearly all tall, robust men, most of them with healthy complexions and of good military bearing. All the volunteers were equipped with Krag-Jörgensen rifles.

9. On August 16 we left the harbor of Mayaguez and steamed to Ponce, where we arrived in the evening of the same day. The harbor was crowded with American warships, auxiliary cruisers,

and transports; but as a result of the peace negotiations, many of the warships had received orders to return to Guantanamo or to proceed to the United States, so that the harbor was considerably cleared during the next few days. General Gilmore, in the absence of General Miles, who was then at Coamo, had established the headquarters of his staff at the custom-house. The United States garrison was encamped near the harbor on both sides of the main road leading to Ponce. The camp consisted of ordinary tents, with camp beds raised a few feet above the ground. As it always rained several hours during the day and usually all night long, one may easily imagine the condition of this camp. Men were constantly at work digging new drains for the water. At times the guards and patrols surrounding the camp had to wade in the mud up to their knees. It is a wonder that there was not more sickness in the camp, for the American general told me there were only a few cases of malarial fever. But exposure to the burning rays of the sun, to constant rains, and the exhalations of the soil is extremely dangerous in this climate, as the residents know only too well, and cannot fail but have its injurious effects sooner or later. As a matter of fact, many cases of fever have subsequently developed among the American troops. I cannot understand why the military authorities had not exercised greater care. Would it not have been better to send the troops to Coamo, which is located on much higher ground, leaving only a small garrison at Ponce? Such a garrison would have been quite sufficient for the protection of the latter town, and might have been quartered in public buildings, such as the church, the theater, etc. The United States transport steamers are said to have had on board all the material necessary for the construction of a small shipyard. If it is true that they carried their preparation to that extent, then better provisions should also have been made for taking care of human lives. If it was not deemed advisable to quarter the men in the towns, then corrugated-tin barracks should have been taken along, which can be taken apart and speedily erected on piles driven into the ground. Ordinary tents were certainly inadequate.

10. On one of the following days we made an excursion to the vicinity of Coamo, about 30 kilometers from Ponce. The beautiful, wide road extending all the way to San Juan is a true work of art, and makes it possible to advance rapidly. The whole dis-

tance from Ponce to San Juan, about 135 kilometers, can be made in vehicles, by changing the horses twice, in fourteen to sixteen hours. The rise is very gradual. On both sides are small huts of natives with corrugated-tin roofs, or covered simply with palm leaves and built on piles about 1 meter high. Soon we came out upon the open country, where wooded hills and valleys alternated with coffee plantations and banana and sugar-cane fields. The profuse tropical vegetation, especially the slender palms with their magnificent crowns, is a constant delight to the eye. After the rain, which had been falling all through the preceding night, the foliage was particularly green and fresh and the shady road nearly free from dust. In several places the road is crossed by the river, which can usually be forded. Where it is too rapid bridges have been built. Upon reaching Juana Diaz the landscape becomes even more beautiful. The heights afford a splendid view of the whole region from the coast to the high mountain range. At Coamo we left the main road and soon reached a beautiful valley made famous by the "Baños de Coamo." There is a large hotel for the accommodation of visitors. The bathing establishment also is very conveniently arranged. A natural spring furnishes sulphur baths. The only thing that reminded us of war during our trip were a few squads of American cavalry and long trains of wagons, each drawn by six mules, which were taking the necessary supplies to the troops encamped at Aibonito. From what we could learn, it seems that the American authorities were preserving excellent order and safety at Ponce and vicinity, but the Puerto Rican inhabitants showed their hatred for the Spanish so openly that, in spite of the strict measures taken by the Americans, there is danger of demonstrations by the inhabitants in that direction.

11. On August 23 we made a second visit to San Juan. The mines in the entrance had been removed and the channel was marked by buoys in the usual manner. Besides the Spanish gunboats Isabel II., General Conche, Creola, and Ponce de Leon, and the torpedo-boat destroyer Terror, there were neither war nor merchant vessels in the harbor. The city itself presented the same aspect as before the blockade. It was not until the latter part of August that steamers arrived and commerce and traffic were re-established. I took advantage of our presence there to learn further particulars about the engagement between the tor-

pedo-boat destroyer Terror and the United States auxiliary cruiser St. Paul. The commander of the Terror gave me the following account of the battle:

At 9 A. M. on June 22 the lookout at the fort signaled a suspicious vessel. The commander gave orders for the Isabel II. to go out to reconnoiter and for the Terror to be ready for action. By 11.30 the vessel had come closer and the Isabel II. went out. Upon sighting her, the hostile cruiser immediately hoisted her flag and waited. The Isabel II. opened fire on the foe. The destroyer then received orders to go out and assist the Isabel. The Terror, which had been left by her fleet at Martinique, had not been able to recover her guns and ammunition, which during the voyage had been transferred to the Maria Teresa in order to make room for coal. The Terror therefore had no other weapons than her torpedoes and two 57-millimeter guns, with little ammunition. The Isabel fought the St. Paul at a distance of from 10,000 to 12,000 meters. As the utmost range of our guns was only 4000 meters, we could not assist the Isabel by going closer to her. I therefore gave orders to head the Terror east, so as not to interfere with the Isabel firing north on the enemy. When we were sufficiently clear of her and had the open sea before us, I headed straight for the St. Paul at a speed of from 20 to 21 knots.

The enemy, who hitherto had been firing on the Isabel, now directed upon us the well-aimed rapid fire of both of her batteries, the lower one of which appeared to have eight, the upper one ten to twelve guns. At 4000 meters we opened fire with our guns, in order to keep up the spirit of the crew during the interval between the beginning of the hail of projectiles and the launching of the torpedo. Our fire was very accurate. At the first shot we saw the shell explode on the stern. Several other shots also hit their target, and our men were wild with joy. We had approached to within 1200 meters and were about to launch the torpedo when the Terror commenced to veer to starboard. I had the helm shifted to port, but the ship kept on turning. Then I ordered the port engine stopped, and still the ship continued to turn to starboard. I then learned that a shell had exploded on deck and destroyed the leads to the steering gear and telegraph, so that the vessel followed the movements of the screw and was unmanageable. The hand-steering gear was at once put in operation; but as we passed the enemy at such close range, several projectiles hit us, one of them passing through the port side into the engine room, where it burst. The engine room became flooded and the engine appeared to have been disabled. We just managed to steam into the harbor.

From an inspection of the Terror it appeared that the fatal shell, ranging obliquely downward, had passed through the ship's side, torn off a steam gauge, killed three men, and struck the lower edge of the main steam pipe, tearing off its covering. This had deflected the shell, and it had passed out through the starboard side. It was through the hole made by the projectile in passing out that the engine room had been flooded up to the lower edge of the steam cylinder; but the engines continued to run, so that the Terror, though with gradually slackened speed, was able to reach the harbor under her own steam. The shortest distance between the Terror and the St. Paul had been 800 meters. The gunboat Isabel II., I was told by her commander, had not gone closer than within 6000 meters of the enemy.

12. We then visited the fortification works and made the following observations, which may be considered as a supplement to the description of the bombardments contained in Part III of these Sketches:

(*a*) *Morro Castle*.—On the highest terrace are three 15-centimeter Ordoñez guns of 30 calibers length and two 24-centimeter breech-loading howitzers of modern type; direction of fire northwest to west. On the next lower terrace are two 15-centimeter Ordoñez guns. These are all the guns that had been mounted. No guns were dismounted during the bombardments. The walls of the fort are over 6 meters thick and extremely solid. They show many hits of heavy, medium, and light artillery. The heavy projectiles had entered the walls to the depth of 2 meters and torn large pieces out of the masonry work. The smaller projectiles had done very little damage, which had already been repaired. One shell had struck the corner of the wall on the lower terrace and killed two of the men serving the guns and wounded several others by shell fragments and débris.

(*b*) *Cristobal Castle*.—Two 15-centimeter Ordoñez guns of 30 calibers length, trained north, fired about eighty rounds during the bombardment. A little to the rear are three 24-centimeter breech-loading howitzers of modern type. At one of these an enfilading shot passing over Morro Castle had struck the breech and killed one man. As a result of this accidental hit, and to protect the men serving the farther guns against shell fire and débris, earth traverses had been thrown up between the guns after battle. A little further back and to the east three 15-centimeter guns, with an arc of fire north by way of east to southwest, and hence also adapted to fire on the land, were mounted on central-pivot carriages. These took part in the fight with about thirty rounds. Finally, at the Princesa Battery, adjoining Cristobal Castle on the east, there are four more 15-centimeter guns and

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two 24-centimeter howitzers. Cristobal Castle and the Princesa Battery sustained only a few hits, slightly damaging the outer walls.

(*c*) The howitzer and gun batteries of the harbor entrance show no serious injuries. Morro Castle appears to have been the main object of the American fire. The fact that many shells did not explode has been much commented upon.

(*d*) Besides the fortifications mentioned above, the Spanish had erected a new battery at Escambron, with three 24-centimeter howitzers of modern type in central-pivot mounts, for indirect fire. For land defense a series of earthworks had been erected near San Antonio and armed with mortars and bronze guns.

13. As we left Morro Castle Spanish soldiers were engaged in taking down the shield with the Spanish coat of arms over the main entrance. As the remains of the ever-glorious Columbus had been removed from the cathedral at Havana, where they had a beautiful and well-cared-for resting place, so it was also desired to carry to Spain this escutcheon, which for centuries had been the witness of the victories and greatness of the Spanish nation. When both of these—the remains of the man to whom the whole world owes so much and the emblem of Spanish power—reach Spain there will be profound sadness throughout the whole country over the final loss of its colonies. The history of this short struggle is another example of the instability of power and fame in the ever-changing destinies of the nations of the earth!

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SEAVEY'S ISLAND PRISON AND ITS ESTABLISHMENT.

By Lieut. R. H. Jackson, U. S. N.

The naval battle of Santiago left about 1700 Spanish prisoners on board the American men-of-war and auxiliary vessels.

What disposition should be made of them was now a problem.

The Navy Department solved it by selecting a site on Seavey's Island for a military prison and camp, and at once let contracts for building a stockade, erecting barracks, kitchen, closets, etc., bringing a water-supply to the camp, and furnishing provisions. All arrangements were made for the comfort and health of the prisoners, provided the contractors could fill their orders, and worked with dispatch.

Information having been received that the first vessel loaded with prisoners would arrive on Monday, July 11th, the Department wisely telegraphed Paymaster Loomis to proceed immediately to Portsmouth, N. H., and report to the commandant for duty as commissary of the camp and assume such duty at that place.

Taking the next train the paymaster arrived at Portsmouth Saturday morning, and having reported to the commandant, went out to the camp to see if everything was in readiness for the prisoners. What might be termed the quartermaster's and the commissary's departments seemed in need of most energetic measures. The kitchen or cook-house was only outlined by a few frames, and some flooring, and there was no sign of a stove, or shelter for stores and provisions when they should arrive. This was Saturday afternoon, and the prisoners were expected Monday morning.

Taking a steam launch post-haste for Portsmouth the paymaster rang up the Department at Washington (of Supplies and Accounts) over the long distance telephone. He reported that, though he was ready to furnish provisions and supplies for the prisoners, there was no place for cooking them, or storing a reserve supply. The substance of the reply was, that the Department wished every preparation to be made for the health and comfort of the Spanish prisoners, and it conferred upon him all authority to adopt such measures as would facilitate that result. Clothed now with full authority as quartermaster and commissary, the paymaster interviewed the contractor for the erection of quarters, storehouse and kitchen. "The kitchen must be under cover to-night, and the storehouse to-morrow," said the paymaster. "It can't be done, it is impossible," was the reply. "It must be done," said Loomis, and it was done. "Where are the stoves for the kitchen?" They were awarded to another contractor. So the stove-dealer was interviewed. "I want fires in the stoves to-morrow night," was the greeting. "Why, there is no place ready for them; moreover, the stoves are still in Boston." "The kitchen will be ready, and the stoves must be in place with fires lighted in them to-morrow night before I leave the stockade," was the ultimatum. Sunday night 21 ranges were in place, lighted and ready to roast and boil for 1700 men. Cooks were to have been furnished, but had not appeared on Sunday; so by a diligent search of Portsmouth Sunday afternoon, 10 were obtained.

The next morning the transport was sighted coming up the harbor; by noon 700 prisoners were mustered ashore and marched into camp, sitting down to a hot dinner of hot coffee, fresh beef, fresh bread, potatoes and onions, probably the first "square meal" of fresh food that they had enjoyed since sailing from Cape Verde Islands.

Immediately after landing each man received a hammock, mattress and two blankets. Hooks were arranged in the barracks, so that the men slung their hammocks at night and lashed and stowed them in the morning.

The meals were served at 7 a. m., 12 and 5 p. m. Meat was usually issued for breakfast and dinner; it was at first issued for all the meals, but it was found that a number were made ill by this excess over their accustomed allowance of meat—one meal


Interior View of Stockade Cook Room showing twenty-one Somersworth Grand Ranges adopted by United States Government
SOMERSWORTH GRAND

only, or even none at all. Three tables were arranged near the entrance to the mess-hall, and the squads were marched in lines between them, pannikin in hands, and the servers-out helped each man to his portion, the men passing to seats at the table in the mess-hall; the time occupied in serving out a meal to the 1700 men varying from 10 to 20 minutes, according to the bill of fare, dinner always taking the longest time.

Better and more experienced cooks than those first obtained were gradually added by the Navy Department till the number reached 20. Then the Spanish cooks began to assist, in order to get the pickings and perquisites belonging to cooks the world over, so that the final number was about 30.

All needful clothing and even shoes were furnished them, the latter a luxury to which many, no doubt, were but little accustomed. At first the medical officers detailed by the Department attended to all the sick as well as to the sanitary condition of the camp; but Spanish medical officers were soon able to look after the bodily ills of the prisoners; and two Spanish priests, who were among the captives, looked after their spiritual welfare.

Drinking water was brought down in a pipe from a neighboring reservoir in sufficient quantities to supply the camp.

A line of closets was established overhanging the banks of the Piscataqua, and the kitchen sink drained into its swiftly running waters; so by vigilant policing, the camp could be maintained in a perfectly sanitary condition indefinitely.

Sentries were established on beats overlooking the stockade, along the water-front, at the water-supply, and at the barracks; bugle calls of reveille, meal-formation, taps, and barracks were introduced, and the routine went on without incident.

The officers were paroled, and spent their afternoons in Portsmouth, apparently enjoying themselves heartily.

The only danger apprehended was from fire—one who knows Jacky's fondness for a sly smoke in his hammock can readily appreciate this fact; and after tobacco had been issued to them, constant and successful effort was made to prevent smoking in the barracks.

The camp broke September 12th, and the prisoners sailed for Spain, healthier, stronger, and better fed than in all their lives; they are no doubt still recounting to open-mouthed and half incredulous friends and kinsmen how the Americans gave them meat twice a day, and even shoes to wear. The cost of this good, wholesome food (and plenty of it) was found to have averaged, for the two months, 19 cents a day per capita.

The colonel commandant, who twice inspected the camp personally, reported:

"September 2nd and 3rd I thoroughly inspected the camp and prisoners, with the commanding officer of the marine barracks, Lieut.-Colonel Mead, who had a few days before relieved Colonel Forney, and I could hardly realize the great improvement which had taken place in the condition of these men. The prisoners were drawn up in two lines in their respective barracks, and I inspected every prisoner in the camp. Most of them were dressed in white suits, all the clothing was very clean, and the men looked well and contented. Their bedding was opened and found to be clean and neat. I also inspected the grounds, barracks, sinks, mess pavilion, and other buildings at the camp, and found them clean and in a perfectly sanitary condition, showing that great care had been bestowed upon the men and camp by Colonel Forney and Lieut.-Colonel Mead, as to health and comfort, since they landed at Seavey's Island."

For resource displayed in utilizing the material at hand, the perfection of details and promptness of execution, the establishment of this camp, though one of the minor incidents of the war, is deserving of great commendation; and the prompt initiative of the commissary, in his dual capacity of commissary and quartermaster, in forcing matters to a successful issue, when quick work is needed, is an example by which the service may well profit.

PROFESSIONAL NOTES.

THE LESSONS OF THE SPANISH-AMERICAN WAR.

The hostile operations between Spain and the United States, considered as a war, have not afforded many practical object-lessons to the naval strategist. It is a matter upon which we have mixed feelings. Object-lessons in war cannot be learned without much letting of blood on both sides; therefore, as simple humanitarians, we rejoice that so few lessons were learned during the late warlike operations; it would be almost too much to call them "war"; there was so little hitting back by one side. But our humanitarianism, like most of our qualities, good or bad, is compound rather than simple; so, with a balance of feeling in favor of our own countrymen, we would like such military object-lessons as may be needed by mankind to be paid for by the blood of others rather than by our own. If, however, we put aside our war standard, and compare the amount of instruction received on a peace basis—as represented by naval maneuvers, theoretical disquisitions, or that most problematical of guides, the war game—we find a wealth of instruction; enough to keep our naval strategists and tacticians busy for the next year or two, showing the results of the war to be proof of the soundness of their own special theories.

War has its consolations, just as peace has its victories, and they come to the warrior oftener than to the citizen. Amongst those to whom the Spanish-American war—for we must perforce give it its courtesy title—has brought most consolations, as a set-off against the inevitable unpleasantness of fighting, is no doubt Admiral Colomb. He is, every one knows, as amiable and gentle a sea warrior as ever longed to blow a ship's company into eternity, but before the war had progressed far he made some remarkably shrewd forecasts of what should happen, and, to his great glory and satisfaction, now that the war is over it is seen that things should have happened just as he foretold. That they did not, exactly, is beside the mark. The principles were sound, and if events did not justify them, that must be laid to the blame of events. In all seriousness, however, it may be said that the Spanish-American war has shown the soundness of the views that Admiral Colomb has put forward with so much perseverance through many years past. Years before Captain Mahan wrote, he industriously preached the great doctrine of naval supremacy and the futility of military preparations—more especially in the form of fixed defenses—unless supported by adequate naval force. He showed the small fear we need have of invasion so long as there was a "fleet in being," and impressed the wisdom of sending our fleet anywhere to seek an enemy's ships rather than keeping in home waters; or, in other words, that the best protection for our coast was to seek out and destroy the fleets of the enemy, all other operations being subsidiary to this first need for our existence as a great power among nations.

At the present time these principles have become almost truisms in the popular mind, and the navy now receives the consideration it merits, and which expediency demands for it. This sounder policy is largely due to Admiral Colomb; far more so than the general public appreciates. If, as some think, he has occasionally overshot the mark in the enthusiasm of advocacy, his main contention has been sound, and the thanks of the country are specially due to him for his untiring and disinterested labors. On Wednesday, March the 8th, he contributed a paper to the Royal United Service Institution, in which he set forth some of "The Lessons of the Spanish-American War." Perhaps, some critics may be inclined to say, one of the most remarkable of the "lessons" is that Admiral Colomb has learned there may be some virtue in a fixed defense. He speaks of the difficulty of grappling telegraph cables in deep water and says: "The lesson appears to be that it is not impossible that if we were at war attempts might be made to damage us in that way (*i. e.* by cutting our cables in shallow water); and it seems a legitimate conclusion to assume that the ends of our cables ought to be covered and protected by a few of the longest-ranged guns properly mounted in a battery."

Admiral Colomb holds that the proper strategy of the Americans was to send a sufficient force to the coast of Spain. "The seizure of Minorca as a base would," he says, "probably have been an easy operation; and in any case it would have been morally certain that if this action had been taken nothing offensive on the other side of the Atlantic could have been thought of by Spain. Then for Cuba and Porto Rico, landings for conquest might have been effected at leisure." Unhappily for the Spaniards, "nothing offensive" was possible on either side of the Atlantic with their ill-served and ill-fitted ships, but that, of course, was not known at the time. The strategy Admiral Colomb advocates, supposes that America possessed a sufficient fleet to seal up the Spaniards in their ports, and also a surplus of ships capable of destroying any vessels Spain might have sent to West Indian waters; and which might have constituted "a fleet in being" absolutely forbidding—according to Admiral Colomb's own teaching—any operations of the nature of landing troops. That consideration, however, does not affect the wisdom of seeking the enemy's ships wherever they might be, so far as strategy was concerned, but probably political considerations had weight in this connection, as the author suggests. In regard to the efficiency of "the fleet in being," it may here be said that Admiral Colomb holds "that whatever the restraining power of 'a fleet in being' might be, when fleets moved according to the wind, it would be enormously increased by the employment of steam propulsion."

The author of the paper condemns "the sort of panic" that reigned all along the Atlantic coast of the United States, because Admiral Cervera was at sea, and no one knew where nor when he was likely to turn up. He says:

"I wonder how much money was wasted in preparing by means of fortifications and submarine mines to meet—not to prevent—attacks that were least likely of all the possibilities of war. We have heard of the inconveniences suffered from the presence of submarine mines in the American ports, but we have yet to hear of the little annual bill which will for years be presented for the scheme of local defense of the American coasts, which it seems is certain to be adopted. . . . As long as we look at things from the side of the defenders, it seems the most reasonable thing in the world to close the harbor of New York by submarine mines, batteries, and what not in war time, lest an enemy's squadron should come inside and bombard the city. . . . Naval commanders will run into considerable dangers in order to get at ships. But towns are not their business. If towns are to be attacked there will be a landed army and all things regular. No naval officer with his hands free would, in war, proceed into New York harbor in order to damage New York—even if he believed there were no batteries and no mines to prevent him."

Of course the views of Admiral Colomb, and those who think with him, as to the assured immunity of towns and cities from attack by hostile craft, are challenged by a large number of authorities; and certainly an influential school amongst Continental strategists hold that a cause may be helped by operations of this nature which they will not scruple to undertake. Even in this short war we find an instance of the value of such a power, when Admiral Dewey silenced the batteries at Manila by a threat of bombarding, not the batteries, but the town, if his ships were molested. If such a concession could be obtained, why not others? Doubtless the ultimate issue of a war could not be determined by occasional bombarding of coast towns and ports, but the experience would be very unpleasant while it lasted.

After all, this question of ship defense or fixed defense is a matter of cost. A ship is better than a fort because of its mobility. Very true; but those who tell us this also tell us we have not ships enough. If we ask "Why?" we learn that it is because ships cost money, and we spend all the taxpayer will find; in short, money is the limiting condition. Now, to bottle up and blockade the fleets of our enemy we need three ships for every two bottled up; and if we take a very possible alliance against us, we find little more than a balance of vessels between ourselves and our opponents. This brings about a condition of a number of unbottled ships of our adversary free to carry out their avowed intention of preying on our commerce or bombarding our defenseless coast towns. Still looking at the matter from an economical point of view, how are these towns best protected? They lie at a distance of every few miles all round the English coast. There may be twenty unbottled cruisers of our enemy, and it might take two, or perhaps three, forts to keep them at a harmless distance from any one town. Each town must have its own fort or forts, and there are more than twenty towns. The question then arises, Would it be cheaper to build thirty more ships to bottle up the enemy's twenty, or to construct forts sufficient for defense of all the towns?

Forts are certainly cheaper than ships, and they cannot be sunk, but then ships can go out and sink other ships, which forts cannot do, therefore the enemy's vessels always remain as a menace, so far as the forts are concerned. Mine fields are of very limited use. They cannot be extended indefinitely, and modern naval guns are effective at long ranges. It is not very likely that an enemy's ship would venture far into inland waters whilst there was a possibility of a superior force catching him in the trap. The bombardment of London, or even Gravesend, would presuppose the loss of the sea to us, and in that case fixed defenses would be of small avail. There is, however, the important consideration of the defense of our oversea commerce, and that needs ships, not forts, although certain defended positions would be desirable for merchant ships to make for at need.

As we have said, the problem is one of finance, and we trust it has been duly worked out by our intelligence departments. It is to be feared, however, that each branch of the service thinks so exclusively of its own function that no combined effort of this nature has been attempted. This aspect of the question is one of the first importance, a fact that was illustrated during the late war when the Americans, almost unopposed as they were, suffered considerably by the lack of cohesion between the naval and military branches. The respective values of forts and ships should be doubtless settled by compromise. Admiral Colomb himself points out the protection and assistance that forts can afford to ships; and where such cheap auxiliaries to the navy can be made effective, it would be foolish to neglect them. The need of safe havens in which ships can refit, or in which they could take refuge in the face of superior force, are among the foremost teachings of history, but to hope to put it out of the power of hostile vessels to hurt us anywhere simply by fixed defenses is beyond hope. After all, if we go to war, we must take our chance of being hit, and the craving for absolute safety is not one that can be satisfied.

The absence of torpedo operations was a feature in the war that caused a good deal of surprise to many people. The Americans made so much use of the torpedo in their own Civil War—considering, that is, the very imperfect state of its development at the time—and the weapon seemed so fitted for the ingenuity and mechanical audacity of the race, that we fully looked forward to some new and diabolical departures in this field. As a matter of fact, however, the American Navy had nothing very effective in the way of torpedo craft, and the Vesuvius with its dynamite gun, which was to have worked such wonders, proved comparatively a failure, so far, at least, as rendering efficient aid to the fleet was concerned. The Spaniards, on the other hand, possessed some fast and well-equipped vessels; but these, like the rest of the Spanish fleet, had been allowed to fall into such a deplorable state that probably little could have been expected from them had they had the chance of operating.

Admiral Colomb refers to the danger from conflagration resulting from shell-fire. Since the battle of Yalu this lesson has needed no enforcing for those who will take the trouble to read plain facts. Admiral Colomb agrees with the late Admiral Sir Cooper Key, who, thirty-three years ago, said that the danger from fire, through the bursting of shells, even in wooden ships, was not great. It was not that fires would not be started, but with well-disciplined crews they would be taken in time and easily subdued. It is the case over again of "the carpenter's cap being the best fire extinguisher in a theater," and Admiral Colomb rightly says it is a question of men rather than materials. Still it is wise to reduce combustibles on a warship to the lowest limit, either by treating wood chemically or by substituting metal for it. This is an important point we shall return to again. The admiral does not approve of the present arrangements for pumping service or fire service in our ships. He has "never reconciled himself to the main drain, nor to the main fire service of pipes," but is more inclined to the isolation of compartments; "feeling that in one case there would in emergencies be an unexpected flooding of compartments supposed to be cut off, and in the other a breach of continuity in the water-pipes." When he had to consider the matter formerly, however, he could see no alternative, but now he is of opinion that "the dynamo, the motor, and numerous alternative electrical communications offer conveniences for isolating compartments as to pumping and flooding service."

There is one other point that we will mention before closing our notice of Admiral Colomb's valuable paper; a contribution which will be printed in full in the *Journal of the Royal United Service Institution*, where all interested in these matters should refer to it, as we only touch on some of the most salient features. The remaining point is the effect of gun-fire on the thickness and disposition of armor, the question arising in connection with the risk of conflagration through shell-fire. A theory largely held was, and doubtless is, that no armor was better than thin armor, as shells would go through unprotected sides and thus right through the ship without bursting, but if there were even thin armor, the resistance would be sufficient to cause the shell to explode. This resulted in a small area of very thick armor and a very large area quite unprotected. In reference to this Admiral Colomb says that:

"Experiments undoubtedly showed that projectiles which penetrated armor, especially if they broke up, created much greater interior havoc than such as passed clean through thin plating intact. Hence the argument was, that there should be no armor except such as would stop everything, and that otherwise everything should be allowed to go through. The logic was sound enough if it could be guaranteed that the enemy would only fire heavy projectiles. But as the policy left 3-pounders effective, it was inevitable that they would be effectively used. To me the real point was a balance between the gun and the armor. If the balance were to be drawn at 3-pounders it was still a balance, so that the loss due to letting 6-pounders through was compensated by the gain of keeping 3-pounders out; or if the balance were to be drawn at 6-pounders, then the loss due to letting 12-pounders through was compensated by the gain of keeping 3-pounders and 6-pounders out, and so on."

The reasoning here is quite sound in principle, the difficulty of course lying in balancing the chances. It should, however, be remembered that when the Inflexible was designed—which ship the author refers to as being inferior in her system of armor to the original La Gloire, and also to the Achilles and Minotaur—the principal armament was almost the only armament, and it is the wonderful growth in the efficiency of secondary armaments which has caused designers very logically—and often very courageously—to alter their plans and adopt a system that may have been premature at the time it was first suggested. The earlier ships manned had to be armored to meet what was practically wholly a secondary armament, and now that secondary armament is once more to be in the ascendant, we have a return to the older conditions.—*Engineering.*

THE SPANISH-AMERICAN WAR.

A mass of official correspondence relating to the late Spanish-American War has recently been published by the United States Government. It consists chiefly of letters or dispatches that passed between the Government and the naval officers on the scene of action, and is contained in a bulky volume published as an "Appendix to the Report of the Chief of the Bureau of Navigation" for 1898.

The British citizen, into whose hands this volume may fall, versed only in the ways of our own secretive government, will be astonished at seeing so many things that we consider almost sacred, and for official eyes alone, published abroad so that all the world can read. When our natural prudery becomes a little blunted by custom, as it must in going through the volume, we ask ourselves, "What harm is done by this openness of speech?" and the answer appears to be, "Very little; and what there is is far more than balanced by the good." It is well the public, who pay the bill, should know (after the event, when no sinister result will follow through the enemy also gaining knowledge) how well or ill the servants of the state have done their duty. With the higher permanent officials of the government departments there is often no other means of punishment for neglect or incompetence than public censure; but want of knowledge blunts this weapon. There is a great deal too much of the spirit of trades-unionism in the Civil Service for the sins of omission or commission to be brought home to individuals. It is always the fault of the system, or, at worst, the department. Now, although we are very far from saying that they manage public affairs better in the United States than we do in England, yet in the publication in question very concise particulars are given, so that if there had been failure on account of unpreparedness, the American public would have known pretty well where to put the blame. Had there been the assurance of such a publication as this hanging over the heads of our own military departments, certain untoward events in our own history, due to forgetfulness, or worse, and which resulted in loss of life and treasure, would hardly have occurred, because there would have been the fear that an indignant public would have demanded swift punishment. As it is, only those concerned know that some neglected their duties; but no one is punished.

Other publications have also been issude by the Office of Naval Intelligence from abroad, by the secretary of the United States Navy, and by the engineer-in-chief. From these various sources a great deal of information as to the strategy and political aspect of events may be gleaned. With these features, however interesting they may be, we cannot hope to deal, as being somewhat beyond our scope and certainly outside the limits of our space. There are, however, certain matters bearing on naval matériel, etc., which may be with advantage put on record in our pages.

One of the most interesting features in the report of the chief of the Bureau of Navigation consists of reproductions of a series of photographs of the disabled Spanish ships. These show in a very impressive way how destructive is the fire of the modern artillery when properly handled. The first series of these photographs illustrate some of the ships that were destroyed at Manila. It will be remembered that on May 1, 1898, the United States squadron, under Commodore—afterwards promoted to the rank of Rear-Admiral—George Dewey, consisting of the U. S. S. Olympia (flagship), Baltimore, Raleigh, Petrel, Concord, and Boston, attacked the Reina Cristina, Castilla, Don Antonio de Ulloa, Don Juan de Austria, Isla de Luzon, Isla de Cuba, General Lozo, Marquis del Duaro, El Curreo, and Velasco. There was also a transport and a water battery at Cavite. It would be a profitless task to compare the respective strengths of the squadrons, even if we had full material to do so, as the Spaniards could make hardly any defense. As a matter of fact, at Manila, as elsewhere, the Spanish ships were not in a condition to fight. Many of them might almost as well have been merchant vessels.

Two mines were exploded ahead of the Olympia as she steamed into the bay, but too far off to do any damage, and the opportunity of defense by fixed engines was almost neglected. The American squadron maintained a continuous fire at ranges varying from 2000 to 5000 yards.

The Spanish fire is described as "vigorous but generally ineffective." The shore batteries also replied, but the latter description may evidently be also applied to their fire, as the American squadron was "uninjured and only a few men were slightly wounded." In fact the Americans had practically a "walk-over." This does not detract, however, from the credit due to them for the efficiency and readiness of their fleet, or from the courage and determination shown by Admiral Dewey and those under his command in entering the enclosed waters of Manila harbor—which might have been expected to be heavily mined—in order to get at the enemy's ships, and in spite of shore batteries.

Whichever way our political sympathies may turn, we cannot but admire the courage and self-devotion of the officers and men of the Spanish fleet. All that could be done with defective matériel and lack of practice was done by the Spanish sailors. Early in the engagement they put out towards the Olympia with the intention of torpedoing her, and this it will be remembered in broad daylight, with no prospect of being unobserved. Of course, it was a forlorn hope, or rather there was no hope; it was only an effort to make some sort of defense for the honor of the flag. The fire of the American ship soon put the boats out of action. "The Spanish flagship Reina Cristina," to quote from Admiral Dewey's report, "made a desperate attempt to leave the line and come to an engagement at short range, but was received with such galling fire, the entire battery of the Olympia being concentrated upon her, that she was barely able to return to the shelter of the point." The shell-fire of the Americans at this time set the vessel on fire and she burnt until she sank. The American squadron had opened fire at 5.41 A. M., and by 11.16 the entire Spanish squadron was in flames. As a result three Spanish ships were sunk, including the flagship, and eight were burnt, while two tugs and several small launches were captured.

The photographic reproductions referred to are, as stated, interesting; unfortunately more so than instructive, from the fact that very little is to be gathered in detail. The Reina Cristina appears to have had the whole after part of her superstructure destroyed, but whether this was due to projectiles or fire does not appear. The forward part seems to be less injured. One funnel was broken clean off, and is shown lying in almost a horizontal position; the other has a large hole in it. The next photograph shows the Castilla, with her rail just awash, and other vessels are in a similar state. A deck view of the Isla de Luzon does not give indication that the vessel had been in action, otherwise than from the circumstance that the decks are awash; in fact, this ship appears to have received so little damage to her upper works, that, so far as the photographs go, she might have been sunk by collision, if we except a view taken under the poop, where deck-beams are shown bent and plating stripped off. The fact may be taken as evidence of the excellence of the American fire, which was doubtless at the water-line.

The damage done by the Spanish fire was too trivial to need recording at length. Some plates were indented and planks torn up in the American ships, whilst a little damage was done to rigging, etc., but nothing serious enough to be instructive. On the Olympia an ammunition hoist was temporarily out of use on account of the blowing out of a fuse. The following extract may contain some useful lessons:

"The right gun worked well with the electric batteries. Battery of left gun failed to explode the primer after the first shot; also resistance in dynamo circuit broken. Used percussion primers in this gun with good results after the first shot. The after turret fired 13 shells. Had three misfires with battery of right gun and two with dynamo circuit as fuses blew out. In renewing fuses they were immediately blown out; so shifted to percussion primers with good results. In left gun one shell jammed, after which used half-full and half-reduced charge, which fired it. The smoke gave considerable trouble, and in both turrets the object glass of the telescopic sights became covered with a deposit from the powder, which had to be wiped off frequently. These are, nevertheless, considered good sights for heavy guns; but it is recommended that bar sights be installed for emergencies. The batteries for 5-in. guns found unreliable. Used dynamo circuit with good results. Ammunition poor. Many shells became detached from the cases on loading, and had to be rammed out from the muzzle. Several cases jammed in loading and extracting."

How poor a chance the Spaniards stood may be gathered from the fact that the Castilla was so crazy that she had, before the action, to be stopped up with cement to an extent that made it "impossible to use her engines"; and even then she was only "nearly watertight." The three American cruisers, according to the Spanish Admiral, concentrated their fire upon his flagship, the Cristina. At the beginning of the action one shell exploded in the forecastle and put out of action all the men serving four quick-firing guns, making splinters of the foremast, and thus wounding the helmsman on the bridge. Another shell set fire to the crews' bags; but a far more serious result was the complete destruction of the steering gear by a shell. Yet another shell exploded on the poop and put nine men out of action, while another hit the mizzen mast and brought down the flag, which was immediately replaced. A shell exploded in the officers' cabin, covering the hospital with blood, and killing the wounded who were being treated. Another shell exploded in the ammunition-room astern, filling the quarters with smoke and preventing the working of the hand-steering gear. It was impossible to control the fire, and the Admiral had therefore no choice but to flood the magazine, as the cartridges were beginning to explode. Other shells of smaller caliber did great damage. One disabled thirteen men, another disabled the starboard bow gun, and the ship was on fire both forward and aft. The broadside guns were, however, undamaged, and with these the fight was continued until there were only two men remaining unhurt and available for firing them. The ship thus being out of control and riddled with shot, half the crew, including seven officers, killed or disabled, the Admiral gave orders to sink her before the magazines should explode. This was done, the crew being taken off by the Cuba and the Luzon, two ships which afterwards shared the same fate. Admiral Montojo then rehoisted his flag on the Isla de Cuba, and fought until all his ships were sunk, when he escaped to shore after having been wounded in the leg.

Thus ended the battle of Manila, if battle it can be called, when on one side hardly a man was hurt; the American casualties consisting of four sailors on the Baltimore receiving slight flesh wounds from splinters. However glad one may be, that those who speak our mother-tongue met with so little disaster, one cannot but sympathize with the devoted Spaniards, who preferred death rather than succumb without striking a blow for their navy and their flag.

We have yet to deal with the naval operations in the West Indies, with which Admiral Cervera was most directly concerned, being in chief comiand, but it may be interesting if we here turn to the views of the Ad-iiral as expressed before the commencement of hostilities. The Madrid aper *La Epoca*, published last November some articles dealing with this ubject, and the revelations did much to enlighten the Spanish people as o the way affairs had been conducted. The articles consisted largely of xtracts from letters written previously by the Admiral. In January, 898, he wrote a letter to a relative in which he referred to another letter ritten two years previously. This letter he had requested his corre-pondent to keep as his vindication, if, to quote his words, "we should xperience the sad disappointment prepared for us by the stupidity of ome, the cupidity of others, and the incapability of all, even of those ith the best intentions."

That was written about the beginning of 1896, but in January, 1898, dmiral Cervera found "the relative positions of Spain and the United tates grown worse for us, because we are extenuated, absolutely penni-ess, and they are very rich." The disgraceful state into which the navy ad been allowed to fall is vividly described in the following paragraph, hich we quote as an example:

"There is the Cataluña, begun more than eight years ago, and her hull s not yet completed. . . . The Maquinista Terrestre y Maritimi supplies he engines of the Alfonso XIII; Cadiz, the Filipinas. If Carlos V is not dead failure, she is not what she should be; everything has been sacri-iced to speed, and she lacks power, and remember the construction is urely Spanish. Only the Vizcaya, Oquendo, and Maria Teresa are good hips of their class, but though constructed at Bilbao, it was by an Eng-ishman. As for the administration and its intricacies, let us not speak f that; its slow procedure is killing us. The Vizcaya carries a 14-centi-neter breech-plug, which was declared useless two months ago, and I id not know it until last night, and that because an official inquiry was nade. How many cases I might mention! But my purpose is not to ccuse, but to explain why we may and must expect disaster. But it is iecessary to go to the bitter end, and it would be a crime to say that ublicly to-day; I hold my tongue and go forth resignedly to face the rials which God may be pleased to send me. I am sure we will do our luty, for the spirit of the navy is excellent; but I pray God the troubles nay be arranged without coming to a conflict, which in any way I believe vould be disastrous for us."

The conviction that those under his command would do their duty was ully borne out by the sequel which Admiral Cervera so plainly foresaw. The simple words by which he expresses his resignation would touch he heart of the hardest adversary, and the noble way in which he fought iis imperfect fleet is a thing of which Spain may well feel proud, even in he day of her disaster; whilst his treatment of Lieutenant Hobson, after he sinking of the Merrimac, shows that the Spanish Admiral possessed iot only a courageous spirit, but also a chivalrous disposition that could dmire bravery in an antagonist, and could treat one with courtesy even hough he had just succeeded in placing a formidable obstacle in the way f the Admiral's escape.—*Engineering.*

ELECTRICITY IN WARSHIPS.

In the middle of his presidential address to the members of the Insti-ion of Mechanical Engineers, Sir William White interpolated a remark of no little significance. Speaking of the various methods employed for working guns on shipboard, and the predilection which there appeared to be in this country for hydraulic gear, he said that in recent vessels the Americans had discarded electrical mechanisms. He offered no comment. Many months ago, writing upon this subject we drew attention to a few of the objections to the use of electricity on fighting ships, and we pointed out in particular that the effect of the violent concussions, both from firing her own guns and being struck by hostile shot, would certainly disarrange many of the more delicate devices on a vessel of war. That was before the fight with Spain, and as we cannot doubt that America is making haste to profit by the lessons she learnt at Santiago and Manila, we may with some safety conclude that the electric fittings on board her ships have not proved of that wonderful value and efficiency which peace maneuvers seemed to promise.

Not long ago Lieut. B. T. Walling, of the United States Navy, delivered a series of lectures on "The Diseases of Electrical Installations in the Navy," before the United States Naval War College. They may be found printed in the June and December numbers of the last volume of the "Proceedings" of the United States Naval Institute, and will well repay reading, both by engineers and electricians. Lieutenant Walling probably gave these lectures before the war with Spain had taken place, certainly before the experience which had been gained in the naval actions had been fully digested. In his introduction he speaks with enthusiasm of the use of electricity in the navy. "Ever since the introduction of electricity on board ship," he writes, "there has been a constantly increasing demand for this form of energy, and it is to be anticipated that much larger demands are shortly to be made upon the adoption of electrical power, for turning guns as well as turrets, for operating auxiliaries, for all purposes, in short, which will minimize the present objectionable heat of long lines of steam piping, the annoying leaks of hydraulic apparatus, and the excessive weights of pneumatic appliances." This is all the golden lining; on the other side of it there is a cloud, and we need not follow Lieutenant Walling's lecture far before we find that, even apart altogether from its transmission, the generation of electricity on board ship is far from a simple matter. We must, of course, in reading his notes, not forget that it is his intention to call attention to faults and not to virtues. If one were to judge man's health from a knowledge only of pathological dictionaries, he might be forgiven for supposing that there was no such thing as a sound person in the world. But, making full allowances for this, we are still left with the feeling that of all mechanical devices that find place on board ships of war, the one most open to failure is the high-speed electricity supply engine. Under the best possible conditions the high-speed engine is always a more or less delicate apparatus to deal with. It is, so to speak, a vehicle which is always running away down hill. It demands constant attention and watchfulness, for disaster makes haste to overtake it. With an engine running 80, 90, or 120 revolutions a minute one has time to act upon a warning, but when it is a matter of 300 or 400 turns a minute, there is scarcely time to grasp the fact that something is amiss before disaster follows. It is here that the slow, steady, unruffled running of the pumping engines which supply hydraulic power to our gun mechanisms have the advantage over the, may we say, hysterical efforts of the electrical plant. That electricity has, in certain respects, advantages, no one will question for a moment. It is possible to lead wire in places where tubes could not be conveniently carried, and it is possible to place motors in places unsuited to hydraulic engines. For these reasons the smaller guns on ships can be worked and served by electrical power when the complication of hydraulic supply debars it from competing. Then, too, it is, or could be made, lighter as a whole than hydraulic arrangements, and Lieutenant Walling claims as "the greatest weight in favor of electricity, the ready change from electrical to hand control in emergency, and the facility of maintaining and repairing leads." As regards the repairing of the leads, we admit that it is easier to mend a copper wire than a hydraulic pipe, but that the change from electrical to hand power is easier than from hydraulic we fail to see. If Lieutenant Walling will look into the hydraulic mechanism of any of our recent vessels we venture to think he will find that the change to hand power can be performed with quite as much rapidity as the change from electrical to manual effort on board any of the ships of the United States Navy. Of pneumatic power we do not write; it has never found favor in this country, for reasons which it is quite unnecessary to enumerate. We have no hesitation in saying that it will not long remain in favor with the Americans.

In another place in his address Sir William White used words to the effect that there were still many persons who would like to see greater dependence on manual labor than there is now on our ships of war. Their position is both intelligent and intelligible, and it is only when taken to excess that it becomes ridiculous. In the British Navy, with the exception of the biggest guns, all arms are worked by hand. Every gun of the secondary armament is thus perfectly independent; and though every machine in the bowels of the ship were destroyed, yet a single gun with one man in an unwrecked casemate might prolong the fight. This is an advantage of which Englishmen will always be proud. Moreover, there can be little or no doubt that far more confidence will be felt in action when the guns are worked manually, than when the uneasy feeling is abroad that a chance shot, in a far part of the vessel, may throw a gun out of action at an instant of extreme importance. Could a more terrible event be imagined than when a torpedo-boat was rapidly approaching covered by a group of guns, elevated and trained by electricity, for, just at the critical moment, the leads to be cut by a hostile shot, and the guns rendered motionless, and this too late to make the alteration to hand power and to avert destruction? With large guns the case is, of course, very different. In our recent ships the largest mountings are provided with hydraulic, electrical, and hand power, and these are to be used in the order given. Hand power is unsuited for such heavy work, as even when a large number of men is employed the operations are performed but slowly. In one respect, however, hand power is still found to be quite as satisfactory, if not more so, than either hydraulic or electrical gear, and that is, in the working of the breech mechanisms of heavy guns. There is no necessity here for great speed, because with manual power the gun can be prepared for a new charge quite as soon as the hoists can supply it. Many attempts have been made to devise effective automatic breech gears, and there are some now at work, but, on the whole, it has been found that hand power gives the most satisfaction.

Of other objections to which electrical transmission on board ship is open, and which have influenced our naval constructors against its adoption, we have not space to speak in any detail. The danger of fire from short circuit, the difficulty of locating a leak or defect, and the fact that the power is supplied by an engine which may suddenly collapse, are among the principal reasons.

But besides the working of guns, hoists, etc., electricity has been used for a number of minor purposes on foreign vessels. It has been, and is still, used for telephones, for range finders, for signalling, and in all navies for lighting, but with the exception of the last it is but little employed in our navy, because it is felt not to be as trustworthy as other methods. This is a fact to which the Americans are at last waking up, and it is evident that the multifarious electrical devices in which they took such pride have not proved in service to be all that could be desired. Even in the matter of lighting, in which there is an accumulated experience to guide us, a useful warning was given in the sudden failure of the supply on board the Burgoyne.—*The Engineer.*

ARMORED SHIPS OF THE FUTURE.

We have been expecting to hear of a distinct change in the application of armor to ships since the Spanish-American war. It does not seem to have taken distinct shape yet; but it must, we think, do so before long. The fact is, that while quick-fire has developed so formidably as to make it desirable to extend armor as far as possible over the hulls of ships, the production of steel plates possessing a high degree of toughness, and at the same time a surface of adamantine hardness, has made it possible to meet this demand. The breakdown of the Spanish Navy has apparently prevented critics from carefully examining certain lessons that are afforded by the events of the war; lessons which, we venture to think, are now sufficiently plain. No incident is more instructive than the behavior and fate of the Cristobal Colon at Santiago. Unfortunately for Spain, when Admiral Cervera made the attempt to break through the American fleet, he elected to push his own ship, the Teresa, to the front, and placed the Colon third in succession, by which means he played his principal game with a ship deficient in quick-fire, and with a hull so totally unprotected, and liable to be set on fire, that her destruction was but the work of minutes; while the Colon, strongly armored nearly all over, and with a powerful battery of quick-fire guns, was so placed that it was probable that she would effect nothing. She ought to have led the way, closed with the Brooklyn, and poured in her quick-fire at such a range as would have secured hitting and not missing. This was in all respects feasible. The Spanish gunners shot badly enough; but we are discussing the powers of ships, and to plead that certain gunners were bad is to drag a herring across the true scent. As a matter of fact, moreover, the Spaniards must have stood to their guns at all events, for the number of hits on funnels, turrets, and masts shows that a great volume of fire, directed too high, passed over the Brooklyn. The latter has a hull better protected from catching fire, but exposed to destruction by langrage nearly as fully as those of the Spanish cruisers which suffered so much. On the other hand, only her principal guns could perforate the Colon's armor, even directly; and it is not likely that more than a little dead metal would have entered her hull, except at the extreme ends. Her 5-in. guns would have broken their projectiles harmlessly on the Colon's armor, as is actually recorded in the one 5-in. hit noted on the accessible part of her hull. The captain of the Colon, in the order adopted, was very likely not to make trial of her powers, seeing that immediately in front of him was the Vizcaya exchanging quick-fire with the Brooklyn, and it happens that these two vessels were formidable in quick-fire, while, curiously enough, both had smoke-giving powder. It could hardly be recommended that the Colon, unless it had been distinctly pre-arranged, should thrust herself in between them. So it came that, passing on the shore side of her leaders, she ran her inglorious course, receiving only enough shot to remind us how completely her armor protected her, surrendering without injury, and without probably having inflicted any injury worth mentioning on the American ships. It is easy to conceive that the Colon's powers may have escaped recognition, because she was deficient in her principal guns. So cruelly crippled did she appear with her barbettes empty, that her power may easily have escaped estimation. As a lady flippantly put it, "In this condition was she not rather a semi-Colon than a full Colon?" Certainly; but we are considering her in her "semi-Colon" condition, and deliberately say that for the task in hand we could name very few better ships in the world. She needed speed protection, and power of delivering fire powerfully for a few minutes. Speed she had, for she got away at first, making a spurt which left the American ships five miles behind. Protection—she had sufficient to deflect harmlessly the projectiles that struck her; and that her energy of fire was good is easily calculated. Had she actually crippled the Brooklyn, and escaped with only a tolerable and reasonable amount of injury, as we think she ought to have done, the authorities of all nations of the world would have ordered vessels of her type before this. As it is, we think it is only a matter of time before this happens, and for this reason we would call attention to her class. That class consists of six ships; two Italian cruisers, the Guiseppe Garibaldi and Varese; two cruisers built in Italy and sold to Argentina, the Garibaldi and San Martin; and two built in Italy for Spain, the Colon and Pedro d'Aragon. Each ship has a displacement of 6840 tons; each is covered from bow to stern with a water-line belt of 6-in. steel made at Terni, practically on the Harvey system. The same armor both as to kind and thickness covers the barbettes, and is carried over the whole of the central portion of the hull, from barbette to barbette. Astern the armor beyond the barbette is carried to the level of the quick-fire battery deck, thus leaving only a small portion fore and aft unprotected. This 6-in. Harveyed armor is a complete match under service conditions for 6-in. quick-fire guns; in fact, the vessel has little to fear from shell fire. The armament is in each case as follows: Two 10-in. guns, ten 6-in. quick-fire, six 4.7-in. quick-fire, ten 2.2-in. quick-fire, and ten 1.4-in. quick-fire. The speed is 20 knots.

Surely, the powers thus secured for a vessel of only 6840 tons may be regarded as an indication of what new possibilities are opened by the introduction of hard-faced steel armor. The type is certainly open to objection in some respects. For example, the coal capacity is small—600 tons is, we think, too little. Nevertheless, there is evidently the possibility of adopting the main principle illustrated by this type, that is, the recognition of the disproportionate protection given to belts and upper structure, and the grasp of the fact that 6-in. Krupp plate affords very fair protection to the water-line, and its adoption opens the possibility of covering nearly the entire hull with it, or something approaching it. To lay down anything in detail would require the staff of a construction department, but what is obvious to "the man in the street," if he has his attention directed to it, is that we have before us a class with a displacement of only 6840 tons, with high speed, and with a hull covered nearly completely with armor far thicker than the quick-fire batteries of French men-of-war, which are only from three to four inches of ordinary steel; thicker than those of the Russian men-of-war, which have for the most part five inches of armor; thicker than the armor above the belt of our own Hood, Barfleur, Centurion, and Royal Sovereign class; and equal to that employed in the casemates of our strongest and heaviest battleships; and this may be done mainly by contenting ourselves with the same thickness of belt as has been adopted for the vertical belt protection of the Canopus battleship class.—*The Engineer.*

WAVE ACTION IN GUNS.

By Frederick H. McGahie.

The regularity of action of smokeless powders has been made the question of the day in American ordnance circles by the destruction of a rifle during proof at Sandy Hook. The matter is now receiving a thorough examination by an investigating board, and all knowledge derived from past experience and theoretical investigation will be brought to bear upon this most important phase of propellants, for it is manifestly clear that the value of higher ballistics is negatived entirely if the powder or system employed is accompanied by a decrease in the safety given as compared with the one to be superseded. The facts of the explosion are these: A new 10-inch rifle was being proved by Dupont smokeless powder made in accordance with the Schüpphaus-Maxim patents. Other rifles of the same caliber and type had been successfully tested in the same manner, and the powder has acted normally. The powder consisted of short grains with seven longitudinal perforations, the formula being the standard army one of 75 per cent. nitrocellulose and 25 per cent. nitroglycerin. In the gun in question a charge of 141 pounds had been fired, giving a pressure of 32,000 pounds. This charge was increased a few pounds to obtain the service pressure of 35,000 pounds, the increase being calculated by the Sarrau formula, which has been used most satisfactorily the world over for many years. Disaster followed the command to fire. The breech-block was blown off with velocity sufficient to make it penetrate the protecting butt directly in the rear of the gun and to kill the recorder of tests. The breech-tube was knocked off. As to the condition of the powder chamber and the rest of the gun, nothing can be known definitely until the report of the investigating board appears. A recovered gage indicated a pressure of 70,000 pounds. These conditions show plainly that detonation did not occur, this explosive action being characterized by enormous pressures developed so suddenly that lines of least resistance are utterly ignored in the destructive effects accompanying it. Had the charge of smokeless powder detonated, the whole chamber would have been subjected to an impulsive blow, around 100 tons per square inch, that would have torn it off completely from the tube of the gun and projected it in various sized pieces over the proving grounds. I doubt if a bona-fide case of detonation of a gunpowder charge has ever been clearly established. It serves as an explanation of unknown or unestablished causes. Had the powder cracked up through excessive internal pressure, the sudden increase of burning surface provided by the fragments would have given rise to a dangerous jump in the pressure, which, reacting on the velocity of combustion of the powder, would have carried it still higher before the movement of the projectile had sufficiently increased the expansion volume. Too long a multiperforated or tubular grain will break up into a few, not many, pieces. But the short grains used were far within the limit, and many tons of such powder have been fired since 1894 without giving the slightest hint of such action.

The firings were made in a wide range of guns, with wide variations of loading and ballistic conditions. The accident has been made the subject of several articles in recent numbers of the *Scientific American* and *Scientific American Supplement.*

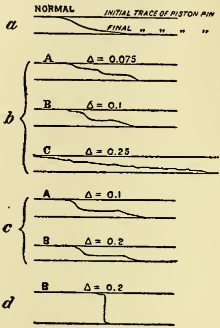
In the light of the above matter the theories advanced by Hiram S. Maxim appear absurd, if indeed the replies of Hudson Maxim do not reveal the nature of those letters as a vicious attack upon an excellent powder, based upon personal animosities.

The phenomenon that took place in the wrecked gun was undoubtedly that conforming in general to the theory advanced by Hudson Maxim in his letter in the *Scientific American* of May 13, 1899. Conditions of loading and ignition, of which no data are at hand at present, originated a wave action in place of the normal distribution of pressure. This surging of the gases moved forward along the axis of the bore with great velocity. Meeting the base of the moving projectile, it was reflected back and impinged upon the mushroom head, which would result in compressing the gaseous column, running up the pressure around the burning charge, and accelerating abnormally the rate of emission of gases. This action itself would tend to abnormal pressures, but especially upon the rapid movement of a considerable weight of powder gases being arrested by the breech, the dynamic movement was translated into an impulsive blow in an axial direction that exceeded the endurance of the breech system. In some features it bore a resemblance to a water hammer.

When the late Capt. Sidney E. Stuart was detailed by the Chief of Ordnance of the United States Army to take full charge of the development and manufacture of service powders, brown prismatic was in use and abnormal pressures were observed every now and then in proving the various lots. A few illustrations are given from the firing records:

GUN.	CHARGE.	VELOCITY.	PRESSURE.	REMARKS.
	Pounds.	Foot Seconds.	Pounds.	
12-inch......	400	1932	36000	Normal
	406	2006	60000	
12-inch......	342	1724	33000	Normal
	350	1804	65000	
10-inch......	200	1813	37600	Normal
	200	1843	59000	

In the above firings the increase of velocities with increase of charge and variation of velocities with equal charges were those normal to single tests of brown powder. The changes in pressure were enormous. In the first group the pressure with 406 pounds should have been in the neighborhood of 37,000 pounds in place of the recorded 60,000 pounds, it being remembered that the gages are screwed into the mushroom head, and their axes are parallel to the axis of the bore. Neither an examination of the lot of powder from which the charges were taken nor an inspection of the factory records of the lot gave any facts to which the pressure variations could be pinned. M. Vieille, one of the group of French explosive engineers who have published in the Mémorial des Poudres et Saltpètres some of the most valuable studies of explosives at our command, had investigated the action of powder gases in long closed tubes in connection with abnormalities found in French practice. He proved the existence of this wave action, and Capt. Stuart applied the theory to American practice with great success.



It will be well to examine this work of M. Vieille. The apparatus consisted of "a steel tube about 40 inches long and 2.4 inches in exterior diameter, the clear interior dimensions being about 35 inches and ⅞ inch respectively. The ends of this tube were threaded and received exactly similar crusher gages, the pistons of which carried pins external to the tube and projecting perpendicularly to it, designed to record the motions of the pistons. Ignition was obtained by an electric fuse carried by a screw plug entering from the side near one end. Obturation was secured by seating the plugs in copper rings. The tube was fastened in a horizontal fashion on a metallic table in the firmest manner possible. A strong axle placed near and parallel to the tube carried at each end a metal cylinder with a blackened surface, so placed as to receive the trace of the pen carried by the piston of the corresponding crusher gage. This axle was rotated by an electric motor by means of a pulley attached midway of its length, in order to avoid differences in the torsion of the axle between the pulley and the two cylinders. The scale of time was obtained by a tuning fork making 500 vibrations per second, which were sustained by an electro-magnet. Various refinements in the character and manner of this portion of the apparatus secured a rigorously exact scale of time, and the whole apparatus operated in a manner insuring a high degree of accuracy in its indications."

Three kinds of powder were used in the experiments, (*A*) musket, (*B*) siege gun, (*C*) large rifle. The conditions of loading were varied in three ways, the charge being distributed uniformly throughout the length of the tube, collected at one end, or collected similarly in equal parts at each end.

While the pressure was developing during an experiment, the piston of the crusher gage would move forward in reducing the height of the copper plug, and the pin carried by it would trace a curve upon the revolving cylinder, the tuning fork meanwhile establishing a time scale. As the weight of the piston was designedly light in accordance with the theory of crusher gages, the deformation of the copper plug would keep pace with the increase of pressures, and would register any momentary excess of pressure due to the compression of the head of a surging gaseous column, arrested at the end where the crusher gage was. M. Vieille put the rectified curves into four classes, typical case being illustrated in Fig. 1. Of these, *a* is the case in which the copper plug was compressed regularly to a normal value, *b* in which the deformation rose to a normal value by steps, *c* in which an abnormal deformation was produced by steps, and *d* in which an abnormal crushing was attained at once. Selecting illustrative data from the experiments, the following table shows plainly the value of uniform distribution of explosives in long tubes.

Powder.	Density of Loading.	Indicated Pressure, Pounds per Sq. Inch.	Class of Trace.	Conditions of Loading.
A	0.075	10,000	a	Uniform distribution.
	0.075	10,900	b	Collected at firing end.
	0.075	9,800 / 10,350	b	" " " "
	0.1	15,800	a	Uniform distribution.
	0.1	23,950	c	Collected at firing end.
	0.1	20,400	c	" " " "
	0.1	21,850	c	" " both ends.
	0.1	24,850	c	" " " "
	0.1	24,500 / 25,400	c	" " one end.
	0.2	34,500	a	Uniformly distributed.
	0.2	107,000	d	Collected at firing end.
B	0.2	29,500	a	Uniform distribution.
	0.2	66,600	d	Collected at firing end.
	0.2	51,300 / 49,300	c	" " " "
C	0.2	29,300 / 26,500	b	" " " "
	0.25	39,200 / 39,300	b	Results normal with uniform distribution in previous tests.

Double pressures mean readings from both gages.
Single readings from gage opposite firing end.

Previous experiments in much shorter éprouvettes (2 to 6 inches in length and 1 to 2.5 inches in diameter) had disclosed no difference in pressures with uniform and ununiform dispositions of explosives varying widely in their quickness. The tests in the long éprouvette revealed another state of affairs, as indicated in the above table. Up to a certain low limit of density of loading, increasing with the slowness of the powder, variations in the placing of the charge made little or no change in pressures. Above these limits the collecting of the charge at one end, or of equal parts at both ends, caused deformation of the copper plugs much in excess of that given by the case of uniform distribution at the same density of loading. This occurred with powders *A* and *B*. It would have taken place with *C* if the strength of the apparatus had permitted a higher density of loading. Referring to the pressure curves, all cases of uniform disposition were included in type *a*, showing that the pressure was developed regularly. Below the density of loading limit ununiform conditions gave curves of type *b*, in which the pressure rose to a normal value by successive steps. Above that limit ununiform distribution produced generally curves of type *c*, showing a development of abnormal pressure by several steps, and occasionally of type *a*, representing abnormal pressure in one step. A study of a large number of experiments of this nature led M. Vieille to the conclusion that " for densities of loading above the limiting values the crusher-gage coppers suffer excessive deformations, which demonstrate the existence of real excessive pressures, due to condensations resulting from the arrest at the ends of the chamber of the gaseous mass in rapid motion.

M. Vieille went further into the nature of this wave action, and experimented with the éprouvette suspended freely, and with crusher-gages whose pistons were too heavy to respond to the momentary pressures due to condensation at the end of the tube of the moving gaseous column. A careful review of the matter led him to formulate the opinion that wave action was possible in large rifles when certain conditions coincided. The influence of ununiform distributon of the charge above certain densities of loading depending upon the quickness of the powder has been noticed. The universal practice in ordnance matters is to employ high densities of loading, much above these limits. The influence of length of powder chamber has been indicated by the difference in results obtained in short and long éprouvettes. This refers to the absolute length, and not to relative length in comparison with the diameter. The prevalent custom of igniting the charge is by means of a primer placed in the breech block, whose explosion, acting on the priming charge, would tend to set up some motion in an axial direction and contribute to pressure irregularity. This is borne out by some firings made in 1891 at Sandy Hook in two 3.2 field guns similar in all respects except that one had a radial vent for ignition of the charge, while the other had an axial vent. Loading conditions were the same, and black moulded powder used in these firings.

CHARGE.	PRESSURE.	
	Axial Vent.	Radial Vent.
3 pounds 5 ounces	36,080	32,500
3 " 6 "	37,600	32,450
3 " 7 "	41,300	33,600
3 " 7 "	38,400	34,000
3 " 8 "	39,500	34,350

It will be seen at once that axial ignition gave rise to higher and more irregular pressures than did radial ignition, confirmed by further tests with black and smokeless powders.

It would appear that wave action may find an origination in these conditions: Length of chamber, high density of loading, end ignition, quickness of powder, and ununiform distribution. The first three of these attend every firing of the large rifles of the day, and it may possibly be that the system of gaseous products of explosion is always on the verge of some degree of wave action that other causes may change, according to their nature, into mere irregularities or large and dangerous jumps in the pressure at the breech of the gun and extending more or less into the chamber.

Capt. Stuart noticed that abnormal pressures occurred with brown powder in the tests at Sandy Hook usually with reduced charges. Full charges were fixed to extend the length of the chamber, but smaller charges were generally reduced in length and not in diameter, providing thereby another favorable condition for wave action. Loading regulations were put into force then at Sandy Hook, designed to secure uniform distribution and regularity of inflammation of the charge. The Chief of Ordnance of the United States Army was able to report a year and a half later: "The occurrence of excessive wave pressure, frequently experienced in the earlier stages of our tests of brown powder, has been practically overcome."

Smokeless powders are at one disadvantage compared with brown prismatic. Any accidental variations in conditions that give rise to an abnormal pressure jump will carry it further with smokeless than with brown powder, for the rate of emission of gases increases more rapidly with the pressure in the former than in the latter. The relation in question is

$$V \propto P^x,$$

in which V is the velocity of combustion of the powder at any pressure P, and x an exponential constant depending upon the powder used. M. Vieille has given these experimental values for x: Brown prismatic powder, 0.45; black powder, 0.55; smokeless powder of 50 per cent. military guncotton and 50 per cent. nitroglycerin, 0.55; smokeless powder of 50 per cent. soluble nitrocellulose and 50 per cent. nitroglycerin, 0.60; and smokeless powder entirely of military guncotton, 0.66. Furthermore, in a gun the action is a multiplying one. Some variation causes an irregular jump in the pressure; this increase makes the powder burn faster and deliver a large amount of gas. This additional increment of pressures increases still further the rate of emission, and so each reacts on the other until the movement of the projectile or the destruction of the gun relieves the pressure. This will indicate the complexity of the smokeless powder question. That article we must have. It involves the drawback just stated. On the other hand, a more uniform product is possible in commercial manufacture. Then, again, in smokeless powders the introduction of nitroglycerin in quantity gives one with a lower rate of emission exponent, manufactured more rapidly and cheaply and having far higher ballistic properties than a guncotton powder. But nitroglycerin means a high degree of erosive action at least, while many contend that it introduces a dangerous mechanical stability into powders and generally lay any trouble with a nitroglycerin powder to its presence. It is indeed a puzzling matter.

To revert to the accident at Sandy Hook, it would seem reasonable that, if the inner jackets of the chamber show no signs of a general dangerous stress, wave action may be safely considered as the cause, coupled possibly with some weakness in the breech system of this particular rifle. If the chamber exhibits plainly that an excessive pressure existed throughout it, wave action must still have a prominent consideration, but the physical condition of this lot of powder enters into the case. Multiperforated powder can be badly made just as well as any other powder. Commercial methods may sometimes diverge from good practice. In 1897 the United States Navy rejected 835,700 pounds of brown powder in getting 699,847 pounds of satisfactory powder. Badly warped and cracked multiperforated powder would not redound to the credit of the system through the results secured in firings. Shipments of cordite have been rejected on these grounds.

Let us examine multiperforated powder as regards uniformity and regularity, as these bear upon the starting of wave action. The general formula may be varied to produce powders running from a pure guncotton to a 60 per cent. nitroglycerin basis. In addition to the incorporation in the usual mixing machine, the ingredients are further mixed and kneaded thoroughly on rolls. From the press the powder issues in rods having exactly the cross-section imposed by the forming die. Good practice in manufacturing insures that the shrinkage in drying is small and regular, this shrinkage occurring with all powders made with solvents. It is less in multiperforated powder than in other powders, and is distributed through at least three burning thicknesses in place of the one thickness of solid grains. The final dimensions of grains are completely in the control of the manufacturer, and accordingly all working details contribute to a maximum uniformity of powder. Matters still favor it in the gun. The gravimetric density of the grain is greater than with any other shape; that is, a given weight of multiperforated powder of any formula, with a given least dimension, will occupy more volume than the same weight made up into any solid grain with the same least dimension. Under these conditions more multiperforated powder can be used for a given pressure than is possible with the other powders. The natural result is that the chamber is more fully filled by the charge, and the danger of ununiform distribution through accident obviated to that degree. An essential point to regular pressures is regularity of inflammation of the powder by the priming charge. For this condition the multiperforated grain is ideal, since the perforations of the grain and the air spaces between the short cylinders afford an easy path for the igniting gases to penetrate and start simultaneous combustion throughout the entire charge. Laminal and cubical grains are sadly lacking in this respect, and their firing records testify to it. The mechanical integrity and structure of the grain rests here, as in other powders, with the personal equation of the factory. The company that developed the powder in question used the most trying formula, and yet every lot delivered gave a satisfactory account in guns, running from the 6-pounder rapid-fire gun to the 12-inch rifle, exciting comment by its remarkable uniformity and regularity of action. Another word in regard to the Hiram Maximized theory of internal explosion of the grains. Were it true nothing but solid rods are permissible. Yet nobody objected to brown powder with its central hole, or to short tubular smokeless powder. The short grains afford easy passage for the gases of internal combustion in their initial dimensions, and combustion increases the area of the passage as the square of the linear enlargement, while the burning surface is growing only in direct ratio. The best testimony of the erroneousness of the theory is given by some grains in the possession of Dr. R. C. Schüpphaus.

After a firing in the 3.2-inch field gun of a somewhat slow multiperforated powder, the pressure being 30,000 pounds, grains were found in the sand in front of the gun burned out perfectly, so that the circular perforations were almost tangent. Though quite fragile, they were perfectly intact. Another sample is an extra slow powder fired in an 8-inch rifle at 15,000 pounds pressure. It is burned up about half and in first-class condition. Again, after a firing in an 8-inch rifle at 35,000 pounds pressure, I picked up many of the curvilinear rods formed by the burning out of powder with circular perforations. Their heights were all uniform, and equal to the original heights less twice the burning thickness, as was to be expected from the combustion at both ends. I regret that the absence of Dr. Schüpphaus does not allow photographs of the grains mentioned, but the *Scientific American Army Supplement* contains one of the grains partly burned at 5000 pounds pressure.—*Scientific American*, May 27, 1899.

THE NAVY ESTIMATES.

The explanatory statement by the First Lord of the Admiralty on the Navy Estimates for 1899-1900 was issued the end of last week as a Parliamentary paper. Mr. Goschen commences by saying that the estimates for the coming year amount to a net total of £26,594,500, as compared with the sum of £23,778,400 voted for the year 1898-1899—showing an increase of £2,816,100. Of this increase the votes connected with the personnel account for £452,600—including an increase of £55,300 in the non-effective votes—which will amount to £1,890,700. Various miscellaneous votes show an increase of £40,900. The works vote is higher by £145,000. The ordnance vote is higher by £161,600. The shipbuilding vote shows an increase of £2,016,000. The liabilities included in this vote due to the supplemental programme of last August amount to two millions.

The total number of officers, seamen, and boys, coastguard, and Royal Marines voted for last year was 106,390, an increase on the previous year of 6,340. On February 1 the number was 105,280, leaving only 1100 to be entered during February and March. There is no reason to doubt that the total number voted will be reached by the end of the financial year. A force of 110,640 is proposed for 1899, being an increase of 4250. The additions proposed to meet the larger requirements of the fleet are 463 officers, 1700 petty officers and seamen, 215 engine-room artificers and artisans, 1000 stokers, 172 miscellaneous, 500 marines, 200 boys under training.

The increase in the numbers voted during the last few years entail a corresponding increase in the number of men in the gunnery and torpedo schools. Additional accommodation has therefore become necessary at Whale Island, for which provision has been made in the estimates.

On account of expansion it has been necessary to increase flag officers from 68 to 80, captains from 208 to 245, commanders from 304 to 360, lieutenants from 1150 to 1550. These additions will be effected gradually over a certain number of years. The number of engineer officers is to be raised from 950 to 1050, the increase to be spread over two years. Medical officers are to be raised from 450 to 490 gradually, chaplains from 59 to 69, and naval instructors from 50 to 60; chief gunners and chief boatswains to be increased from 80 to 100, gunners and boatswains from 920 to 1150, chief carpenters from 18 to 20, carpenters from 207 to 240.

During 1898, 2871 recruits were raised for the Royal Marines, of these 572 were drafted to the Artillery branch, and the remainder trained for the Infantry. The waste of the corps for the year amounted to 138, including men who were transferred to serve as stokers, ship police, artificers, and in other ratings at their request. It has been decided to increase the net pay of the Marine on shore by 2d. a day. The deduction of 7d. now made for rations and groceries from his pay of 1s. 2d. will be reduced to 4d., while, on the other hand, the penny a day for beer money will be abolished. His net pay on shore will accordingly in future be tenpence in place of eightpence. The average number of non-commissioned officers and men on shore during 1898 was 7079. Of this number over 6000 were put through the annual course of musketry training.

The total number of executive officers of the Royal Naval Reserve now on the active list who have served for twelve months or more in the navy, or who are now undergoing twelve months' training, is 243, an increase of eighteen since last year, notwithstanding that 35 of these officers have been appointed supplementary lieutenants and sub-lieutenants in the Royal Navy. In the estimates for last year provision was made for increasing the executive officers' list by 100. The additional officers have all been appointed, and there are now no vacancies, while 175 candidates are on the list of applicants for appointments. By order in council of May 19 last an increase of 100 in the engineer officers' list was sanctioned, raising it to 400 officers. In all 351 officers are now borne, and it is anticipated that the list will be complete in a year at the present rate of volunteering. During the year ended December 31 last 1711 seamen were embarked for six months' training in Her Majesty's ships. On that day 810 of these men were so serving. It is expected that 1800 men will have been embarking during the financial year ending March 31, 1899, an excess of 600 men over the number estimated. Provision has now been made in the estimates for the embarkation of 2000 men.

All the vessels proposed to be commenced during the financial year under the original programme 1898-99 have been begun. Of the vessels included under the supplemental programme the four battleships and two of the cruisers have been ordered, and tenders for the remaining two cruisers have been invited. Tenders for the 12 destroyers have been received, and are now being considered. It was not possible to complete these arrangements at an earlier date, having regard to the preparation of the necessary designs and specifications, and to the large amount of current work on new construction. The expenditure and progress on ships building have been greatly influenced by the unprecedented activity in mercantile shipbuilding, which has followed the settlement of the labor difficulties that so seriously affected the work of last year. The disarrangement of work arising from those difficulties has produced a sensible effect on the completion of ships in 1898-99, the most serious result being the great delay experienced in the supply of steel and other materials required by private firms to whom Admiralty orders have been given. This has been especially felt in the case of ships commenced in private yards in 1898-99. The dates of laying down the ships were consequently later, and the sums earned on these vessels had fallen below what would have been earned under ordinary conditions. The manufacture of armor has been affected by the fact that the introduction of a new and superior quality has necessitated the reconstruction of plant, and involved many difficulties only to be overcome by experience. The output has been greater during the current year, as compared with 1897-98, but the anticipation of the Admiralty that there would still be a temporary limitation of the supply has proved to be correct. All the neighboring firms have been kept full of orders, and urged to increased production, but the earnings for the present financial year will fall considerably below the sum provided in the estimates. It is hoped that in the coming financial year 1899-1900, a larger output of armor will be available on contract work generally, including armor, hulls, machinery, gunmountings, etc. The various hindrances above mentioned will cause the aggregate earnings to fall short by about £800,000 of the estimated amount on ships previously ordered, which were in stages of construction less affected by the peculiar conditions of the year. Excellent progress has been made, and in some cases the amounts earned have exceeded expectations.

Extra expenditure on labor and ordinary materials for new construction and on repairs in the dockyards will to the extent of about £360,000 absorb the short earnings on armor and other contract work.

The battleships Hannibal and Illustrious (Majestic class), which were practically ready for service at the end of the last financial year, were commissioned soon afterwards. Of the Canopus class two (the Canopus and the Ocean) will be completed and ready for trials about June next. The Goliath will follow three months later, and the Albion and Glory will, it is anticipated, be delivered by the contractors in time for completion before the close of the financial year 1899-1900. The last vessel of the class—Vengeance—is being rapidly advanced, and, according to the contract, will be delivered in July, 1900. Of the Formidable class two—the Formidable and Irresistible—were launched before the end of 1898, and the Implacable is to be launched this month. In this case the rate of advancement has exceeded expectation. The four battleships recently ordered under the supplemental programme are intermediate in size between the Formidable and Canopus classes, and have practically the same armament as the Formidable, but are to have superior speed and thinner armor. They are to be known as the Duncan class.

Of eight vessels belonging to the Diadem class, which were in hand at the beginning of 1898-99 two (the Diadem and Niobe) are in commission. The Europe has been for some time complete. In the Fleet Reserve the Andromeda and the Argonaut have completed their trials and will be ready for service by the end of the present financial year. The Ariadne has finished her steam trials and will be completed at an early date. The Amphitrite has been delivered by the contractors and her trials will shortly take place. The Spartiate is being advanced at Pembroke. All these vessels will be ready for service in 1899-1900. Six armored cruisers of the Cressy class are building by contract. Two of these have been ordered in 1898-99 as part of the new programme of four armored cruisers included with the estimates of that year.

Two of the three vessels of the Arrogant class in hand at the beginning of 1898-99, namely, the Furious and Vindictive, have been completed, and one of them, the Furious, has been in commission since July last. The third, the Gladiator, will, it is anticipated, be completed this financial year. Three vessels of the improved Talbot class (Hermes), building by contract, have been well advanced during 1898-99 and will be completed early in the next financial year. The Hermes will be delivered this month.

Of the ten third-class cruisers of the Pelorus type which were in hand on April 1, 1898, the Proserpine, Pactolus, and Pegasus have been completed and are in commission. The Psyche, Pomone, Perseus, and Prometheus will be completed very early in the next financial year. The remaining two vessels will be completed before the end of the year.

Six sloops of the Condor class are in hand. Two of these are to be completed early in the next financial year. The others will be considerably advanced. The four twin-screw gunboats (Dwarf class) building by contract are approaching completion.

The supplementary programme provided for the twelve additional torpedo-boat destroyers. Orders for them will be placed before the end of the present financial year. Of the 42 destroyers, of 26 to 27 knots' speed, two did not complete their trials successfully with locomotive boilers, and water-tube boilers are now being fitted. It is hoped that they will be ready for service during next summer. Of the 50 vessels of 30 knots' speed which have been ordered in previous years, 31 have been tried and delivered, and another has been tried and soon will be delivered. The remaining 18 are well advanced, and some have passed their preliminary trials. Four experimental vessels of still higher speeds have been ordered. Two of these are under trial.

In the coming financial year it is proposed to commence in the dockyards two battleships (design not decided), two armored first-class cruisers 9800 tons, three smaller cruisers (design not decided), and two sloops. By contract it is proposed to build two first-class torpedo-boats to replace others struck off the list. The two sloops to be laid down are to be in their general character similar to the Phœnix and Algerine. They will be propelled by twin screws and be of moderate draught suitable for river service.

The manufacture of guns is proceeding satisfactorily, and the production is keeping pace with the requirements of the fleet. A design of a new and more powerful 12-inch B.L. wire gun has been approved, the first gun has been delivered, and is now under trial. This type of gun will be mounted in the Formidable class of battleships. A new design of 9.2-inch B.L. wire gun has also been approved. The first gun is under manufacture, and not yet completed. It is intended to mount this type of gun in the armored cruisers of the Cressy class and of the Drake class.

The principal new works for which provision is made in the estimates for 1899-1900 are:

At Chatham.—A new building slip and a new foundry. It has been found impossible to reconstruct the old foundry owing to the failure of the foundations.

At Porstmouth.—Extension of No. 5 building slip and the reconstruction of a new smithery.

At Pembroke.—A new smithery.

At Wei-hai-wei.—It is proposed to begin the establishment of a naval depot. Dredging operations have been already commenced.

For hospitals.—A considerably increased expenditure is again required to provide accommodation for the increased numbers borne and to improve the existing buildings. A bill to make provision for the continuation of the works under the Naval Works Act, and for the commencement of certain others, will be submitted to Parliament.—*United Service Gazette.*

ENGLISH AND AMERICAN GUNNERY.

Many complaints have been made lately about the shooting in our navy, and invidious comparisons have been drawn between our gunnery and that of the United States. The question is one demanding attention, because our accuracy of fire might at very short notice become a matter of vital importance, and it would then be too late to make up shortcomings. The subject has an aspect at the present moment which is not altogether free from difficulty. Crudely expressed, the conclusion that appears to loom up is as follows: Our shooting is not up to that of the American Navy. In the fight at Santiago, which is the only action of which we have anything like a record, the American Navy scored something like 3 per cent. of hits out of the total number of rounds fired. If we are to score much less than this the effect of our fire is indeed poor. If, on the other hand, we conclude that skill goes to the winds on actual service, then there is no use conducting annual practice at all. Clearly the question is masked by the difficulties raised by the disappointing results at Santiago. We should observe that we mean disappointing from the point of view of accuracy, for the actual effect of this small percentage of hits was tremendous. The great incendiary effect produced was due to circumstances which were more favorable than would probably be found again. The Spanish cruisers were singularly open to destruction by fire, and their means provided to deal with fire were very inadequate and failed in time of need. The type of ship we are more likely to encounter in the future will be much better protected. If a cruiser, she may be of the type of the Colon, which at Santiago did not suffer any injury worth notice from such projectiles as struck her. Consequently, we may be sure that the American Navy would not contemplate with equanimity the prospect of making only 3 per cent. of hits in future actions. The first point is to account for this result, and to ascertain if there is a really satisfactory way of accounting for it, and we may say at once that we can hardly conceive circumstances where wild firing would be more certainly provoked than those of Santiago. The Americans were tired out by an uneventful watch round the harbor mouth for several weeks. One hot morning, without the slighest warning, the order was given to close and fire on the Spanish cruisers which were moving out. The United States ships were in most cases slower than the Spanish, so their only chance of hitting lay in what could be done instantly. In a quarter of an hour or twenty minutes all the chances for most of the vessels might be over, and the United States ships had drifted out to a distance far beyond that of practical fighting. In about eight minutes firing had begun, but it was at a range of 6000 yards. Nearly every ship fired smoke-giving powder. If men in a state of repose are suddenly told to score all they can in a few minutes at a rapidly-moving enemy, 6000 yards off, concealed in smoke, they themselves moving as fast as possible, what could be expected? Saving ammunition was no object. The wildest attempt made while the range was possible was better than nothing. Could circumstances arise more conducive to wild firing? Further, so much injury was done to the Spanish ships by the burning out of their wood, that a considerable part of the effect of common shell must have disappeared; hence we think that this terribly small percentage of hits may be accounted for, however unsatisfactory it appears. Certainly the conclusion arrived at by the Americans themselves is, not that accuracy is out of the question, but, on the other hand, that it is to be attained by all means, for the annual practice is to be greatly increased, that is, from six practices to fourteen per annum, at ranges, so we are told by Mr. Wilson in the *Daily Mail*, of from 800 to 3000 yards.

Now to come to the invidious, but perhaps valuable, comparison that has been raised between our own shooting and that of the American Navy. It must be understood that the comparative number of hits made by vessels in annual practice is very deceptive. In the case of our own fleet, we believe that it will be found that ships on the Pacific station year after year obtain better results than those elsewhere, because the conditions under which they fire happen to be more favorable. The American heavy guns fire at a target 56 ft. long, and 16¾ ft. high, which is enormously larger than our target. Without, however, disparaging our own gunners, who probably do very well according to the opportunities afforded them, we cannot fail to conclude that we must be at a great disadvantage if we practice much less than the American Navy, which it appears is the case. Latterly, happily, attention has been awakened to this question. Our admirals are doing what they can to encourage good shooting at their various naval stations, and the Admiralty are increasing the amount to be spent on annual practice. Let us hope that this is only the beginning of better things. At Crete the British ship engaged fired with such success as to present a striking contrast to her foreign consorts; nothing, however, can be built on the results of two or three rounds. It is well to be glad that we appeared to advantage, while, at the same time, taking means that as little as possible shall be left to chance in any future war. Money can hardly be better spent on any purpose connected with war which would yield such fruit as that laid out in perfecting our shooting.—*The Engineer.*

THE SUPERIORITY OF THE BRITISH BATTLESHIP.

If experience at sea under all kinds of weather is to prove a valuable factor in the next great naval war, then the British Navy, writes E. H. Mullen in the course of an article on "The Problem of Battleship Design: A Defense of Sir William H. White, Director of Naval Construction of the British Navy," appearing in the current issue of *Cassier's Magazine*, has the advantage of every other navy in the world. The mere ordinary reliefs of 200 war vessels of all kinds at present in commission, and spread over every quarter of the globe, mean in the aggregate an enormous amount of cruising through calms and storms, or steaming from cold climates to hot and vice versa. Out of this experience has come the prevalent British practice of having all warships good sea boats; and from this there has followed, at first perhaps unconsciously, but now as a carefully studied art, the designing of war vessels to be good gun platforms in fair weather or foul.

An observer who saw the British and French fleets meet in mid-channel in 1895, as escorts to the Tzar of Russia, who was then visiting the principal countries in Europe, says that the British ships were as steady in the choppy sea as if they had been riding in a land-locked harbor, while the French ships danced about so much that many of the officers and men were palpably seasick. Now men who are seasick are almost as much hors de combat as if they were severely wounded.

On the other hand, a warship may be a good sea vessel, and yet, owing to the low elevation of her guns, may not be able to use them in a storm. Lieutenant E. W. Eberle, U. S. N., has said that the United States battleship Oregon, which proved herself to be an excellent sea boat, could not have fought any of her 13-inch guns during a gale, or for hours afterward, and could have fought her 8-inch guns only at intervals in rough seas. This argument in favor of the high freeboard in the Majestic and Canopus classes is apparently irresistible.

In practice shooting, made to resemble service conditions as nearly as possible, the British Navy attains an average of 30 per cent. of effective hits, but no one expects this average to be maintained during the excitement of an action. If the Olympia had maintained this average at Manila she would have made ninety-six effective hits, or enough to have destroyed the whole Spanish fleet single-handed. It is, therefore, in the opinion of Sir William White and his fighting chiefs at the Admiralty, not so much a matter of the number of guns as the excellence of the shooting with those that are provided. Moreover, with 6-inch quick-firing guns, using 750 pounds of shot and cordite every minute, it becomes a matter of practical difficulty to keep more than a certain number of guns supplied.

It is to Sir William White's credit that amidst all the mechanical complexities of the modern warship, he never lost sight of the fact that without men a warship was merely a costly lump of steel. Quick-fire guns, light and heavy, well dispersed and each with a wide angle of fire; ample protection for gunners and stokers alike, plenty of ammunition, coal and supplies; a good gun platform in rough as well as fine weather—these were the qualities realized by him in the Majestic, and these have made her a favorite type for imitation by naval architects of other nations.—*United Service Gazette.*

COLOR-WEAKNESS AND COLOR-BLINDNESS.

It is generally accepted as a well-established fact that the traveling public is fully protected by the present tests for color-blindness to which railway employees and pilots are subjected. Yet several of the mysterious accidents that have occurred during the last two years might be explained on the supposition of color-blindness on the part of responsible lookouts. In fact, I believe myself in position to prove that persons of dangerously defective color-vision actually do pass the regular tests and obtain positions where their defects are continual dangers to public welfare.

In the first place, I have at the present time among my students one who is absolutely perfect at the wool-test. He can match wools with incredible precision at any distance away; he is, nevertheless, color-blind. This case is typical of a class of persons with eyes abnormally acute for differences in color, but yet with only two fundamental sensations instead of three.

In the second place, I have had among my students those who possessed perfect color-vision for near objects or bright objects, but who were practically color-blind for weakly illuminated or distant objects. These persons possess the typical three fundamental color sensations, but have one of them weaker than the normal. A person of this kind may pass the wool-test with the utmost perfection if the test is performed close by, but will fail if the wools are removed to a distance of 20 or 30 feet. This peculiar defect I take the liberty of terming "color-weakness." The first student of this kind that I examined passed the wool-test close at hand and yet was unable to distinguish red and green lanterns a few hundred yards away. Cases similar to this have been reported by the British Marine Examiner, Edridge-Green. Among other cases he quotes a letter from an engineer containing the following statement: "I have been on the railway for thirty years and I can tell you the card-tests and wool-tests are not a bit of good. Why, sir, I had a mate that passed them all, but we had to pitch into another train over it. He couldn't tell a red from a green light at night in a bit of a fog."

To eliminate both these classes of persons we must have a method of testing on quite different principles from the usual ones.

In the first place, the sorting of delicate shades of colors, according to likeness, must be replaced by *naming certain fundamental and familiar colors.* The sorting of wools is a quite unusual and perplexing task to a man brought up in a railway yard and on shipboard. It puts a nervous man at quite a disadvantage; it furnishes the unsuccessful candidate with the excuse that the judgment required was so unlike any he had made before that he failed from nervousness; and, finally, it is not a guarantee that all who pass are not color-blind. The naming of colors should —as Donders proposed—be rigidly required. The engineer or the pilot in his daily routine is not called upon to match colors, but to decide whether a light is red, green or white; he should be tested on just this point. The color-blind student referred to above who can pass the wool-test to perfection fails at once when called upon to name the wools. The naming of delicate and perhaps unusual shades should, however, not be required; the colors to be named should be the three familiar ones: red, green and white, so manipulated that every possible chance for confusion is presented.

The second necessity for eliminating danger is that of an absolutely certain test which shall detect both the color-blind and the color-weak. Acting on the basis of suggestions from the work of Donders and of Edridge-Green, I have devised a test that meets this requirement as well as the first one.

The instrument* which I have invented may be termed the "color-sight tester" or the "color-sense tester." In general appearance it resembles an ophthalmoscope. On the side toward the person tested, there are three windows of glass, numbered 1, 2 and 3, respectively. The opposite side of the tester consists of a movable disk carrying twelve glasses of different colors. As this disk is turned by the finger of the operator the various colors appear behind the three windows. At each movement of the disk the subject calls off the colors seen at the windows. The windows, 1, 2 and 3, are, however, fitted with gray glasses. No. 1 carries a very dark smoked glass; all colors seen through it will be dark. No. 2 carries a piece of ground glass, showing all colors in full brightness. No. 3 carries a light smoked glass. There are thus thirty-six possible combinations of the colors. The twelve glasses are, however, mainly reds, greens and grays.

A suitable arrangement of the colors gives direct simultaneous comparisons of reds, greens and grays of different shades. The well-known confusion by color-blind persons of dark greens with reds, greens with gray, etc., are exactly imitated, and the instrument gives a decisive test

* For those interested in obtaining the Color-Sight Tester I will say that I have made arrangements to have it made by the Chicago Laboratory Supply and Scale Co., Chicago.

for color-blindness. Its peculiar advantage, however, lies in the fact that it presents reds, greens and grays simultaneously in a large number of different shades of intensity. The light of a green lantern, at different distances or in a fog, is simulated by the green behind the different grays; at the same time a white light is also changed. The color-weak person to whom weak green is the same as gray (white at a distance) is utterly confused and thinks that the weakened green is gray (white) and the dark gray is green.

The actual test is performed in the following manner: The tester is held toward a window, at about 2½ feet from the person tested. The operator begins with any chance position of the glasses, and asks the person tested to tell the colors seen through the three glasses, Nos. 1, 2 and 3. He answers, for example: "No. 1 is dark red; No. 2 is gray; No. 3 is green." The operator records from the back of the tester the letters indicating what glasses were actually used. If he finds that A, D and G were opposite the glasses Nos. 1, 2 and 3 he records: A 1, dark red; D 2, gray; G 3, green. The disk is then turned to some other position; the colors are again named, and the operator records the names used. For example, the result might be: "No. 1 is dark green; No. 2 is white; No. 3 is red"; and the record would read: G 1, dark green; J 2, white; A 3, red. Still another record might give: J 1, dark gray; A 2, red; D 3, medium gray. Similar records are made for all combinations. Of course, the person tested knows nothing concerning the records made. A comparison with a list of the true colors for each position determines whether the test has been passed or not.

The three records just cited were all obtained from the red glass, A; the gray glass, D; the green glass, G; and the ground glass, J, in combination with the dark gray, No. 1; the ground glass, No. 2, and the medium gray, No. 3. Those familiar with color-blindness will notice that these combinations place side by side the colors most confused.

The records can be taken by any one, and, on the supposition that the record has been honestly obtained and that the instrument has not been tampered with after leaving the central office, the comparison is mechanical. There is none of the skillful manipulation required in the wool-test and none of the uncertainty attaching to its results. The only instruction given to the subject is: "Name the colors"; the results render the decision with mechanical certainty.

One of the testers is in use on one of the English railways, another on the central division of the New York Central Railroad. From the former I have not yet heard, but the examiner on the latter reports that since using the tester he has found men who get through the wool-test, but are caught by the tester. On the other hand, he states that "the men examined say that this test is more like the signals they are used to seeing every day on the road, and is, therefore, fairer than to ask them to pick out a lot of delicately tinted pieces of yarn."

An experience of several years seems to justify the following claims for the color-sense tester:

1. It detects with unerring precision both the color-blind and the color-weak.

2. It is a perfectly fair test for the men concerned and injures no man by requiring an unfamiliar judgment.

3. It requires but a very small fraction of the time used on the wool-test.

4. Its decisions are self-evident and unquestionable.—E. W. SCRIPTURE in *Science*.

THE IMPROVED TURRETS OF THE BATTLESHIP TEXAS.

By Robert W. Henderson, United States Navy, U. S. S. Texas.

The great naval battle of July 3, off Santiago, which ended in the complete destruction of Admiral Cervera's fleet, has shown in the most realistic manner possible that too great a value cannot be placed upon rapidity of fire and rapid-firing guns on board a man-of-war. The battleship Texas took a very important part in this battle, and the efficiency of her large guns is due chiefly to the improvements on her turrets, instigated by Lieut. F. J. Haeseler.

The Texas is a first-rate battleship of the second class, having a displacement of 6315 tons. She is 309 feet over all, has twin screws, triple expansion engines, and on her trial trip she had an indicated horse-power of 8610, giving a speed of 17.8 knots. Her main battery consists of two 12-inch breech-loading rifles mounted in turrets and six 6-inch B. L. R.'s which are slow fire. The turrets of the Texas and those of the Maine are on the same general plan, the port one on the Texas being forward, the starboard one on the Maine, the turrets being situated in echelon. The Texas turrets and barbettes are of 12-inch face-hardened steel armor, while the ammunition hoists and tubes are protected by 8-inch armor. The turrets, ammunition hoists, and rammers are all worked by hydraulic power, the engines being of the three cylinder Brotherhood type. The power is furnished by four powerful hydraulic pumps, all the machinery being inside the armored redoubt.

When the Texas went into commission, it was impossible to load these 12-inch guns except in two positions, pointed directly ahead or directly abeam, the rammers for these two positions being outside the turrets. When firing in intermediate positions, it was necessary to train the gun off the target to load, picking the target up again after loading. This consumed much time, the interval between two shots from the same gun being at that time about seven minutes.

Lieut. Haeseler advanced the idea of carrying a light but strong telescopic rammer inside, which was to revolve with the turret, thus enabling the gun's crew to load from any position. To accomplish this it was necessary, besides securing a strong rammer that could be easily handled, to change the lead of many of the hydraulic pipes, secure a "change" or "balance pressure" valve, and to devise a means of loading inside the turret. A "balance pressure" valve that could be used as a supply, exhaust, and reversing valve was obtained by a slight modification of a "Sellers" valve, and the hydraulic plant was changed accordingly. Immediately behind the breech of the gun, when level, a strong but light telescopic rammer was balanced on trunnions, which permitted its being raised or lowered into working position by one man.

The next problem was to devise a means of transporting the 12-inch shell, which weighs 850 pounds, from the ammunition hoist outside the turret to the breech of gun, as formerly they were hoisted into a loading position forward of the stationary rammers. A circular track carrying a small traveling car was placed entirely around the turret inside the redoubt and a grooved table was put just inside the turret opening. When a shell was sent up from the ammunition room below, it was whipped by a chain strap and differential pulley into the traveling car, run around to the turret opening by one man, and shoved into the stationary table.

Inside the turret another ammunition lift was placed, running by hydraulic power, and fixed so that in its upper position the shell table on it was level with the bore of the gun in its loading position. One man pushes the shell into the shell table; the powder, which is in four sections, is placed in stands beside the shell; the car is hoisted; the shell and powder are run home by the rammer, and the car lowered for another charge. A small loading platform, working on hinges and secured by a hook, was placed under the breech of the gun, to allow a man to wipe out the powder chamber after the gun has been fired. An interesting experiment was tried in regard to sighting the turret guns, which would have been very useful in case of accident to the regular sights. The gun is sighted by means of telescopic sights placed in hoods on each side of the breech, the officer in charge being in this hood and sighting gun. Ordinarily, in case this hood were to be demolished by a shot, the gunners would be unable to obtain anything like an accurate aim.

Through an aperture in the turret, near the gun, a small tube was placed which was laid exactly parallel with the bore of the gun. Cross wires were fitted in the ends of this tube for sighting. Near the elevating slide, at the side of the gun, an arc was fixed firmly, graduated in yards, and a pointer attached to the slide pointed out the yards on this arc, the accuracy of the arc having been tested by the regular sights. To aim the gun by this improvised sight, the gun was trained on the target by means of the fixed tube, and the gun was elevated or lowered until the pointer on the slide showed on the arc the number of yards indicated on the range finder. The test shots with these sights gave very accurate results.

This constituted the repairs that were made on the guns in the New York navy yard, and after preliminary drills the Texas went out beyond Cape Henry, at Old Point, to test the work. The result was even more than expected. A mean between the intervals of five shots was one minute and fifty-five seconds, a vast improvement on the old record, while one interval was as low as eighty-five seconds. The Texas returned to Old Point ready for whatever was to come, and her record during the late trouble showed how completely she can be relied upon.

Formerly, for these 12-inch guns, there were but two kinds of shells, common and armor-piercing, as shrapnel are not used in the larger guns. Common shells are rather long, weigh 850 pounds, and carry a bursting charge of about 60 pounds of powder. Armor-piercing shells are the same weight, but are somewhat shorter, carrying no explosive charge. They are made of the hardest steel, with toughened point, intended, as the name indicates, to penetrate armor. The new armor-piercing shells have soft steel caps on the points, supposed to give them a greater penetrating effect. A new shell that has lately come into use, and which did good service during the late war, is known as a "semi" shell. It is a combination of the other two, of the same weight, has a hard steel head designed to penetrate light armor, and carries in addition a bursting charge of about 50 pounds. This shell is especially designed for use against armored cruisers or vessels of light protection, and is very effective. The igniting fuse for this shell is a base fuse, instead of the old nose fuse used in common shells. Common shells are intended to be used against forts, earthworks, and unprotected vessels, and were used almost entirely against the batteries before Santiago.

It could always be told when a shot struck, as a great cloud of dirt, smoke, and débris would rise in the air as a shot exploded. Several times, most notably during the engagement of the Texas and La Socopa battery, the guns of the Spaniards were completely buried by the earth thrown up by these shells, but the Spanish soldiers had discreetly retired to a pit on the opposite side of the hill, smoking in calm safety, to return, when the ships had retired, with mules and workmen, hauling out and remounting their guns.

While armor-piercing shells are meant to be used against protected vessels, the "semi" shells, carrying an explosive charge, were used principally during the battle, July 3. Of these shots there is a record of but two, both of which struck the Infanta Maria Teresa on the port quarter, entering just under the berth deck. A remarkable feature was that the holes made by these two shells were so close together that they lapped each other, giving a convincing proof that "lightning" does strike twice in the same place. These shots entered and exploded in the after torpedo handling room, and the effect, as seen by the writer, was something awful. Stanchions were cut to ribbons, frames wrenched from the side plating, and the deck beams were severely twisted. Everything in this part of the ship was wrecked, and a large jagged hole, about 4 feet square, was made in the starboard side. The effect of some of the 8-inch shots was nearly as great. The one exploding in the forward turret of the Oquendo alone wiped out the entire gun's crew, and put the gun out of commission.

That the large guns of the Texas did most efficient work is shown by the attitude of the Spanish officers, who not only feared the marksmanship of the Texas, but were surprised to hear that she was not one of our best and most formidable ships. A bright tompion in the muzzle of the starboard 12-inch gun shows by the following inscription the service it has seen: "Santiago de Cuba," "Guantanamo," "Maria Teresa," "Vizcaya," "Oquendo," "Cristobal Colon," "Pluton" and "Furor," "Reina Mercedes," "La Socopa."

The crew of the Texas showed their appreciation of his services by presenting Mr. Haeseler with a beautiful gold watch with the following inscription: "Presented to Lieut. F. J. Haeseler by the crew of the Texas, in appreciation of his services in creating the 'Old Hoodoo' into the 'New Hero.'"

Considering the severe tests to which she has been subjected, it is safe to say that when her slow-fire 6-inch guns have been replaced by rapid-fire guns of the same caliber, there will be no more efficient vessel of her size in our entire navy than the battleship Texas.

The shells are brought to the ammunition hoist in a sling, suspended from an overhead track. The cage has two platforms, the upper of which carries the powder, done up in sections, and the lower the shells. The cage is hoisted by hydraulic power, and the ammunition is transferred from it as already described. On the same deck with the magazines are the engines and boilers, and above them is a steel deck, 2 inches in thickness, which protects this portion of the vessel, known as the "vitals," from shell fire. Along the sides, at the water-line, is a belt armor of 12-inch steel, and between the belt and the boiler rooms are the coal bunkers, which add their protection to that of the belt. A shell striking above the belt would have to pass through several feet of coal to reach the interior of the ship; if it struck on the belt, it would have to penetrate 12 inches of Harveyized steel and several inches of wood backing and many feet of coal before it could endanger boilers, engines, or magazines. The water itself effectually prevents the entrance of shell below the water-line.—*Scientific American.*

A PROCESS OF FIREPROOFING WOOD FOR THE WOODWORK OF WARSHIPS.*

By C. J. Hexamer.

A process for fireproofing the wood of war vessels must possess the following qualifications: (1) The material deposited in the fiber of the wood must render it thoroughly incombustible; (2) moisture or water, whether fresh or salt, must not affect the materials in the wood, in other words, they must be insoluble; (3) the impregnating matter must adhere permanently to the fiber so that it cannot be shaken out by any amount of wear or jarring; (4) glycerin or like hygroscopic substances, used in conjunction with other chemicals to render theater scenery incombustible, must not be used, as they would tend to rot the wood; (5) the entire mass, not the surface only, must be equally well protected by the fire-resisting substance, because in battle the woodwork is broken and shattered, and external applications permeating the wood but a short distance, though valuable in ordinary buildings, would be useless for the former purpose.

Water is not only our cheapest solvent, but also the one universally obtainable, and therefore best suited to be used on a large scale. For this reason I concluded to employ a substance soluble in water in the primary saturating liquid, which, in turn, was to be rendered insoluble by precipitation in the fibers by an aqueous solution of another substance, forming with it an insoluble compound. Such a process, with ideal substances, would possess the additional advantage that the insoluble compound would be precipitated, as infinitesimal particles, into the very fibers of the wood, causing it to remain there permanently. No amount of jarring or vibration could shake it out, for, like a soluble dye-stuff made fast or insoluble by a mordant in textile fabrics, it would last as long as the fibers in which it is imbedded.

Injection into the fibers of the entire mass, and the precipitation there of an insoluble fire-resisting compound is, therefore, the desideratum. The question naturally arises, how can a solution be forced into the innermost recesses of the fibers of thick masses of wood? I knew that the most reliable experimental work regarding the saturation of wood with solutions had been done in connection with various attempts to preserve it against rotting and the teredo or ship worm. Before, therefore, beginning to experiment blindly, I carefully studied what had been done in this direction; examining technical books and journals, Wagner's "Jahrbuecher," the reports of committees, boards of inquiry, state commissions, patent reports and processes in actual use.

As a result of my studies and experiments, I came to the conclusion that the best method for impregnating the entire mass of the wood was to subject it to the following process: In the first place, use only well-seasoned timber, thoroughly air and kiln-dried, and worked approximately into the dimensions needed, or, better still, impregnate, whenever possible, the finished articles. Then place the wood in a strong metal

* Abstracted from a paper read before the Franklin Institute, Nov. 16, 1898.

chamber, specially made for the purpose, capable of withstanding strong pressures, and supplied with a lid that closes it hermetically. The receptacle is surrounded by a steam jacket, so that the temperature in it can be regulated at will. The interior of the chamber must be thoroughly dry before the wood is placed there. Let me caution you against steaming lumber before saturating it, a custom still prevalent in many creosoting works. The laborious tests of Drude have conclusively proved that steaming wood before impregnating it with solutions tends to lessen its absorptive powers, and that, therefore, it should be as dry as possible. The temperature in the receptacle is slowly increased above the boiling point of water, which is maintained until all the moisture in the wood has been expelled and the mass is equally heated throughout. The chamber is then hermetically sealed and the temperature in it is reduced to 60° C., and held there. The air in the receptacle is now extracted as quickly as possible by means of an air pump. The more complete the vacuum the better will be the ultimate results. Few persons have any idea of the amount of air contained in porous substances like wood. After the air in the wood has been removed a solution of water-glass in about three times its volume of water, previously heated to 60° C., is sprayed into the vacuum. This method of injection is used to remove the air in the solution. The solution must not be too dilute, but at the same time not so thick as to refuse to enter the finest tissues of the wood; in other words, it must be of such a consistency that after impregnation it is completely retained in the pores. It is almost needless to add that the final results depend on the completeness with which the moisture, sap and air have been removed from the wood before impregnation.

I will not weary you by recounting the lengthy list of materials employed as a primary impregnating fluid, only to return at last to the one with which I had started—soluble glass, one of the best known of fireproofing materials, which possesses the additional advantage that it is cheap.

I might state here that for ordinary purposes a block of wood can be made fire-resisting by repeatedly soaking it in a water-glass solution, and, when dry, coating it with a mixture of the liquid and cement.

To return to the process, when the wood has become saturated with the solution at normal conditions, hydrostatic pressure of about ten atmospheres is applied, which is kept up for three hours; this drives the liquid through the mass. Numerous experiments made in Germany for the conservation of wood (see Mittheilungen des technologischen Gewerbemuseums, Abtheilung, Holz) have conclusively demonstrated that the "hydrostatic-pressure method" is the only one to be relied upon for forcing solutions to the innermost parts of a log.

The question now becomes what to use to precipitate insoluble silica from the solution of soluble glass, thereby forming an insoluble compound in the fibers? A dilute solution of hydrochloric acid was tried at first, but this affected the wood, and would in practice attack metal receptacles. Gaseous and liquefied carbonic acid were experimented with, also calcium chloride, until finally a solution of ammonium chloride, a very cheap substance, was used with excellent results. This produces in the very fibers of the wood a gelatinous precipitate of silica, most suitable for our purpose; salt, which is readily removed from parts near the surface by soaking in water, tending to preserve the wood in the interior; and ammonia gas, which goes off per se.

To apply this secondary liquid the water-glass solution is drawn from the receptacle, and the before-described process is repeated with the ammonium chloride solution. In practice it may be found advantageous to use a second receptacle, removing the wood from one to the other. The pressure should be applied gradually in the second treatment, so as not to force out the first solution. After the precipitation has been completed the wood is thrown into a stream of running water to dissolve and wash out the salt near the surface, and is then slowly dried.

It may be of interest to add that, as a secondary result of my experiments—by using stronger solutions than are necessary for fireproofing purposes—I had some beautiful specimens of petrifaction, and Dr. Keller so completely turned a piece of filter paper into stone, that it seemed to be a delicate film of some pure white silicious mineral, and no one could possibly have surmised what the substance originally was. It is, therefore, possible that this process can be utilized in the arts in the future to petrify organic substances.

It will probably be urged that my process is expensive; but in a case like this expense is not a factor. We cannot afford to take the risk of not having everything possible about a man-of-war—or for that matter of any ship—fireproof, when upon that fact may depend a victory or a defeat of our navy. Nor is the expense as great as it at first appears; for the Government should attend to this work itself, and not leave it to contractors. In point of fact, I believe it will be found that the only considerable outlay necessary would be the first cost of the large air-tight receptacles. There are, no doubt, plenty of pumps on hand that could be utilized, the amount of labor required is trifling, the chemicals used are of the cheapest, and the plant can be located in a place where running water costs nothing. I therefore fail to see any possible reason why lives on ship should be endangered by fire in the future.

I beg le: . to state, in conclusion, as my humble opinion, that everything on board of a ship can be made fireproof. Some things, of course, must be excluded by necessity, such as food, fuel and ammunition.—*Engineering News.*

THE GATHMANN SHELL TESTED.

The first of the two experiments with the new Gathmann shell took place at Sandy Hook on May 9, in the presence of ordnance officers of the army and navy. The Gathmann shell employs for its bursting charge guncotton in the place of powder, which had not always been satisfactory. Sometimes there is not sufficient gas generated by powder to burst the projectile, and this is particularly true in armor-piercing shells. The great danger from the use of guncotton in shells is premature explosion. The inventor, Mr. Gathmann, believes that his projectile will not explode inside the gun and that it will not explode prematurely on loading it, and that the wet guncotton will only explode by detonation. The chief recommendation of the shell was that it could stand the use of smokeless powder as a propellant. In the experiment an old 15-inch Rodman gun was taken to the beach and a very heavy charge of smokeless powder was placed in it; then a 15-inch Gathmann shell containing 82 pounds of wet guncotton was put in place. The gun was then taken to a hole twenty feet deep which had been dug in the beach and was lowered to the bottom, lying horizontally. An electrical fuse was attached and the bore of the gun filled up with sand and stone to increase the strain of the explosion on the shell. The officers and interested parties got out of danger and the gun was fired. It was shattered with the force of the explosion, which blew out a cavity in the beach 30 feet deep and 25 feet in diameter.

The work of digging for the shell was very severe, owing to the peculiar nature of the sand. The remnants which were found are satisfactory to Mr. Gathmann and his associates. The guncotton had been driven into the sand with such force that it was almost pulverized and, as it was recovered, seemed to consist of about as much sand as guncotton. The breech end of the gun had been shattered and was found in small pieces for a space of 16 feet. The base part of the bronze shell was also found much broken in the breech end of the gun. It was bright on the inside, and this, when added to the evidence of the unexploded guncotton found in the sand, showed that although the shell itself had been broken by the explosion, and although the detonator undoubtedly exploded, the Gathmann arrangement for protecting the charge of the shell had worked perfectly. The muzzle end of the gun for 5 feet was broken into five pieces longitudinally. A portion of the forward end of the shell was found about 3½ feet from where the muzzle of the gun had been. The official report on the experiment will be looked for with interest.—*Scientific American.*

THE BEST FORM OF WATER-TUBE BOILERS.

Passed Assistant Engineer J. K. Robison, United States Navy, in the course of an article in *Cassier's Magazine*, for May, on "The Best Water-Tube Boiler for the Navy: A War Lesson," observes that the arguments for and against water-tube boilers have been gone over again and again until they are threadbare; but the fact that we must have boilers that are capable of being divided into small units and that are capable of quickly generating steam from a cold boiler, must settle the question. Whatever the faults and virtues of this general type of boiler, it must be used to satisfy the manifest requirements of the service. We find that water-tube boilers must be used on men-of-war, but we also find a great deal concerning the type of water-tube boiler that must be used. An increase in the space on board ship devoted to machinery, above the large amount already so allotted, must be avoided. Inasmuch as the grate surface of the new boilers must be greater for the same power developed at the engines, than that in the type of boilers now used, there would naturally be an increase in the boiler-room space required. This must be avoided; and this can be done only by increasing the ratio of grate surface to floor space occupied above that in cylindrical boilers. This ratio must be a large one, and the larger the better.

Considering the crew a ship is sure to have in time of war, and the fact that frequently the water tenders will be new to the ship, and, possibly, even to the type of boiler used, the boilers must not be complex. The number of attachments must be as small as possible to minimize the work of these busy men. No great efficiency in firing must be required to attain a good efficiency of the boiler. This follows from the fact that the firemen in the navy in time of war are not equal to doing any particularly good firing. The fact that no great efficiency in firing must be expected or required, means that the complete combustion of the fuel must not be attempted in one chamber above the fire. There are sure to be holes in this fire. It will not be the same thickness in one place as in another, and the coal will not lie evenly over the grate. At some point, then, beyond which an opportunity for the economical extraction of the heat from the furnace gases is afforded, the gases of combustion must be thoroughly mixed and a combustion chamber furnished. The care of the boiler while steaming must not be attended with any great difficulty. The water level must be steady. This requires a large area of cross section of the boiler at the water level, and in general requires a large amount of contained water in the boiler. This amount of water must not, however, be so great as to interfere with the ability of the boiler to furnish steam quickly from a cold condition. The parts of the boiler must be afforded a free expansion to make the quick raising of heavy fires under a cold boiler possible without any danger of causing leaks. For the same reason, a good, free circulation of the water in the boiler must be assured. As it is not possible to entirely keep salt water out of the boilers, they must be capable of use with salt water, and the interior must be accessible for cleaning. It must be possible to remove salt and other scale from the water side of the heating surfaces. The tubes must, therefore, be straight tubes and not of very small diameter.

The above conclusions are direct deductions from actual war experience. They must be satisfied to satisfy real war conditions.—*United Service Gazette.*

LIQUID FUEL.

At a recent meeting of the British Society of Arts Sir Marcus Samuel, who has been engaged for several years in developing the oil fields of Borneo, read a paper on "Liquid Fuel," which contained several points of interest, particularly concerning the use of oil as fuel in steamships. In speaking of the development of the Borneo fields, he stated that the first steamer employed in the business of transporting oil in bulk through the Suez Canal was a vessel of 4000 tons burden of oil, while the largest of those employed now carried 6500 tons; three steamers are in course of construction to carry 9000 tons of oil each, or 3,000,000 gallons. There was an enormous future before this fuel, even if it only depended upon its relative cost compared with coal; but when they came to the collateral advantages it enjoyed, the benefits of using it, as compared with coal, were simply overwhelming. As showing the immunity from danger, he said that, the business having been conducted for now over seven years, not a single accident of any kind had happened, either to a ship while engaged in carrying oil, or to an installation. Dealing with the relative efficiency of oil and coal, the speaker instanced the performance of the boiler of a launch used in Hong Kong. In this repeated and carefully checked tests had shown that, while the consumption of coal was 7 pounds per minute, the consumption of oil was only 2 pounds per minute. The pressure of steam realized by 7 pounds of coal was from 96 pounds to 105 pounds, while that raised by 2 pounds of oil was sustained at 116 to 120 pounds. The speed realized in the launch under coal had never exceeded 9 knots, while under oil a speed of 10¼ knots was readily maintained. The author then dealt with the application of oil fuel to locomotives, and, in conclusion, said oil could be carried in spaces which it was impossible to utilize in any other way.

Oil carried in the bottom of a steamer, below the water-line, would be impervious to shot, and by the system of service tanks, patented by Sir

Fortescue Flannery, as oil was pumped out of the ballast tanks of a steamer water could readily be taken in to replace it. The importance of the new departure had been promptly recognized by Lloyds, who had issued regulations allowing liquid fuel having a flash point of over 200 degrees F. to be carried in steamers' ballast tanks, and this would greatly facilitate its general use. The speaker said that the experimental stage in the burning of liquid fuel had long since been passed. No less than 7,000,000 tons per annum were consumed in Russia for liquid fuel alone. There are no fewer than eight steamers at present engaged in the Eastern trade which were fitted for it, and the results attained had answered the expectations of their owners beyond their most sanguine anticipations, while large numbers of vessels were under construction expressly for the use of liquid fuel, and a great number of steamers hitherto burning coal were also being altered. In the Far East tanks had been erected at ports ranging from Yokohama to Suez, including all the Indian ports, while cargoes of the Borneo oil had also been landed at the principal ports, and 4000 tons was on passage to London.—*The Iron Age.*

SHIPS OF WAR.

[England.]

Amphitrite.

The first-class cruiser Amphitrite, built and engined by Messrs. Vickers, Sons, and Maxim, Limited, Barrow-in-Furness, completed last week her contract trials in the English Channel. The trials are interesting from several points of view, but notably from the fact that in this vessel experiments were made for utilizing the exhaust steam from the auxiliary engines for evaporative purposes instead of using steam direct from the boilers for this object. Hitherto the exhaust steam from the host of auxiliaries has gone into the auxiliary condenser, occasioning at least two other engines before the condensed water found its way into the feed tank. This has never been a very satisfactory system of dealing with the exhaust steam, for, apart from its cost and extra weight, there was always a greater danger of leaky tubes in this condenser than in that of the main, owing to the intermittent work of the engines exhausting into it; thus salt water was always to be guarded against as coming from that quarter more than from any other. It is gratifying to find that the engineer-in-chief on the one hand and the Admiralty contractors on the other are ready and anxious to conduct steam trials and experiments with a view of arriving at the most economical method of working marine engines and boilers. It was conclusively proved by water test on the Argonaut that the consumption of the auxiliary machinery was as high as 22 per cent. of the total consumption of the main engines working at one-fifth power—about the normal power of most warships—and 10.4 per cent. at three-fourths power; it can be easily understood what a margin is left in this direction for economizing fuel. It was this difficulty of distinguishing between expenditure for propelling purposes and that of auxiliary work which has given that suspicion of empiricism to all Admiralty steam trials; but now that the correct data has been arrived at in the Argonaut, this charge can no longer be levelled at those responsible for these official trials.

It seems unfortunate that, owing to the hastily improvised fittings adopted in the Amphitrite for the utilization of the auxiliary engines' exhaust steam, after a two hours' trial the officers attending on behalf of the Admiralty consented to the abandonment of the test, but this decision was only given because they knew that similar trials on the Vindictive would be of a much more exhaustive nature; but still, so far as the new departure went, it was very satisfactory indeed. A few minor modifications will have to be made in some of the fittings, and after these are carried out, we can safely state that one of the difficulties militating against a comparatively light expenditure of coal will have been removed. The contractors are to be congratulated on the brilliant success of the trials as a whole, for not only did the engines work beautifully and without a hitch, but the economy registered, so far as coal consumption is concerned, is the lowest yet recorded where Belleville boilers, or, in fact, any other type of water-tube boiler, have been tried. The consumption averaged for the eight hours' full-power trial was 1.57 lb. of coal per I. H. P. per hour, and 1.43 lb. of coal per I. H. P. per hour for the three-fourths' power trial. This is very satisfactory, and no doubt a great deal of the success was due to the very systematic firing carried out in the boilers. Arrangements were made whereby a furnace door was not opened at more frequent intervals than six and a half minutes, and then only a minimum of coal with a maximum of distribution over the grate was indulged in. In "clinkering," too, great care was exercised to see that only portions of the fires were done at one time, so that there was not any undue cooling of the fires, and hence imperfect combustion going on. There has been a good deal to be desired in this direction in previous trials of other ships, but now that the Amphitrite has set the standard in this important detail of economy it is hoped that bad stoking will be a thing of the past.

No trouble whatever was experienced with the boilers. After the thirty hours' run at 13,500 indicated horse-power, it was found that one feed collector which extends across the front of the boiler at the bottom of the element of tubes was damaged. There being a spare feed collector on board, it was substituted for the damaged one, and this partly while the vessel was doing her gun and circle trials. We mention this merely to point out with what ease and facility the various parts of these boilers can be taken out and others substituted without the vessel being rendered powerless while the repair is going on. This in itself is one of the leading features of the Belleville boiler.

Another innovation was carried out in the working of the Amphitrite's engines, and that was, no steam jacketing whatever was used round her cylinders and slides. We are not aware whether she is so fitted, but evidently as a result of the experiments carried out in the Argonaut, Sir John Durston has arrived at the conclusion that the jacketing of cylinders is of little or no value when high boiler pressures are carried. In a recent paper read before the Institute of Naval Architects, on "Trials and Experiments in H. M. S. Argonaut," he said: "And it appears that with the comparatively low revolutions and high expansions used at 3600 indicated horse-power, the influence of the jacketing on the efficiency of the steam practically balances the expenditure of heat in the jackets. . . . At the higher power the tests appear to show that no gain in economy is obtained by steam jacketing as carried out in this vessel." Should the precedent set in the Amphitrite be universally adopted in the cylinder arrangement of engines destined to work at high pressures, another wasteful method of using feed water, to say nothing of the multiplicity of fittings, will be abolished.

We shall be pleased to return to this subject again when the results of the Vindictive's trials are to hand, as it is one of paramount interest to all those connected with our steam navy.—*United Service Gazette.*

H.M. Torpedo Destroyer Mermaid.

Recently H.M. torpedo-boat destroyer Mermaid, which has been built and engined by Messrs. R. and W. Hawthorn, Leslie, and Co., Limited, of Newcastle-on-Tyne, completed her full-power speed trial on the measured mile off the Maplin Sands with very satisfactory results, and proved herself to be the fastest vessel of the 30-knot destroyer class yet tried.

The Mermaid is 210 ft. long by 21 ft. beam, and had a displacement of 320 tons when carrying the specified load at the commencement of the trial. The machinery consists of twin-screw, three-crank, triple-expansion engines, having cylinders 19-in., 29-in., and 46-in. by 18-in. stroke. The cranks are set at 120 deg., and balance weights are fitted upon the high-pressure and low-pressure cranks to counteract the vibratory forces. Throughout the trials the vibration was very slight, and the whole of the machinery ran without the slightest hitch. Steam is supplied by four water-tube boilers of the Thornycroft type, having a total heating surface of about 13,200 square feet, and worked at a maximum pressure of 250 lbs. per square inch.

The mean results of the six consecutive runs on the mile are as follows:

No.	Time.	Speed.	Revs. (mean).
1	2 0 5	29.901	395.2
2	1 55 0	31.304	395.5
3	1 57 8	30.562	403.9
4	1 56 2	30.986	394.2
5	1 55 0	31.304	414.7
6	1 56 4	30.928	394.8
	Mean	30.927	400.875

The general results of the three hours' trial are as follows:

Draught of water, forward	5 ft. 3⅛ in.
" " aft	8 ft. 3⅝ in.
Speed of ship, knots per hour, six runs	30.926
" " three hours	30.833
Steam pressure in boilers	225 lbs. per sq. in.
Air pressure in stokeholds	4.96 in. of water.

	Starboard.	Port.
Vacuum in condensers	22.8	22.1
Revolutions per minute	397.8	395.4
Mean pressure in cylinders, high	95.9	97.7
" " inter	51.3	50.8
" " low	17.8	18.0
Mean I. H. P., high	982	992
" inter	1220	1204
" low	1068	1075
Total	3270	3271
Grand total	6541	

It will be seen from the above that the high speed of 30.833 knots was obtained with a very moderate power.

The Mermaid has on all her trials been extremely successful. On her first trip to sea for the contractors' preliminary trial she obtained a mean speed of 30 knots, a performance which, it is believed, has not previously been accomplished by any vessel. On the Admiralty observation trial, before leaving the Tyne, a speed of nearly 31 knots was obtained, and upon her official consumption trial, a speed of 30.149 knots was maintained for three consecutive hours in unfavorable weather. Her full speed trial is as above described. It will thus be seen that this vessel has not once gone to sea on trial without obtaining the contract speed and maintaining it for the necessary specified time.—*The Engineer.*

Glory.

On Saturday morning, March 11th, Her Majesty's first-class battleship Glory was floated from Messrs. Laird's shipbuilding yard at Birkenhead.

The Glory is of the Canopus class, designed by Sir William H. White, K. C. B., Director of Naval Construction, and as this class of vessel is now well known, we will offer only a short description. Her dimensions are: Length, 390 ft.; breadth, 74 ft.; mean draught about 26 ft. 6 in.; displacement, 12,900 tons; freeboard, forward, 22 ft. 6 in.; aft, 19 ft.; indicated horse-power, 13,500; speed about 18½ knots; coal stowage about 2000 tons. The armor is of Harveyed steel, and there is a protective deck from the lower edge of the armor, covering the machinery, magazines, and other vital parts.

The ship is lighted throughout with an installation of about 750 electric lights, and equipped with six search-lights of 30,000 candle-power, each of which is capable of being worked by dynamos under protection. The officers and crew are accommodated on the main and belt decks. The upper deck extends from stem to stern without a break, and above it is a continuous bridge deck extending the whole length between the barbettes; on this deck are the conning towers surmounted by navigating bridges (which will be about 36 ft. above water), and the chart-house. The masts, two in number, are built of steel, fitted with military and signalling tops, and are already in place and complete with their derricks for hoisting boats, etc.

The armament of the Glory will consist of four 12-in. 46-ton guns, mounted in barbettes, in pairs, and firing a projectile weighing 850 lbs., with a powder charge of 148 lbs. There are 43 quick-firing guns in all, twelve 6-in. on the main and upper decks, mounted in casemates protected by 6-in. armor; twelve 12-pounders, six 3-pounder quick-firing, eight small machine guns, and five field guns. There are also four submerged torpedo tubes for 18-in. torpedoes.

The main propelling machinery, constructed at the Birkenhead Iron Works, consists of two sets of engines of the triple-expansion inverted type of the latest design. Each set is placed in a separate engine-room. The cylinders are: High-pressure, 30 in.; intermediate pressure, 49 in.; and low pressure, 80 in. in diameter respectively, with a stroke of 51 in. The boilers, 20 in number, are of the Belleville type (with economizers), working at a pressure of 300 lbs., and are placed in three watertight compartments.

The Glory illustrates the advantage of building these large battleships in dock in preference to building them on a slip and launching them, as she floated out with all her citadel and casemate armor, and most of the barbette armor in place; indeed, all the armor-plating would have been completed had it not been for the press of work in Sheffield rendering it impossible for armor-plate manufacturers to make delivery as early as required. A considerable portion of the boilers is on board. The whole of the auxiliary machinery is in place, and the pipes and connections are being fitted. The main engines are erected on board, with the exception of the cylinders, so that the vessel, as floated out from the building dock, is in a far more advanced state than would have been the case had she been launched in the ordinary way, her displacement on floating out being approximately 9000 tons. This feature is brought into prominence at the present time, as Her Majesty's ship Implacable, of 14,900 tons displacement, for which the machinery of 15,000 horse-power is also being built by Messrs. Laird Brothers, was launched from Devonport, her weight being about 4500 tons. It is expected that the Glory will be ready to hoist her pennant within six months, but the Implacable is not expected to be ready for commission for about fifteen months. The Glory will have a complement of 750 men.—*Engineering*.

Implacable.

The battleship Implacable was safely launched at Devonport, the naming ceremony being performed by Lady Ernestine Edgcumbe. This vessel is sister ship to the Formidable and the Irresistible, and her leading dimensions are as follows: Length, 400 ft.; breadth, 75 ft.; mean draught, 26.9 ft. Her displacement is 15,000 tons, and her estimated speed is 18 knots. She is the largest vessel which has ever been built at Devonport, and she has been completed in a wonderfully short space of time. She was laid down on the same slip from which the Ocean had been launched, on July 15th of last year, and since that time 5300 tons have been built into her hull. It is true that there had been a certain amount of fitting together—which dealt with some 300 tons—on an adjacent slip, but the whole of the work so fitted was taken apart and erected on the slip from which she was eventually launched. The rate of progress has therefore averaged some 150 tons a week over the eight months. Her side armor, which is 9 in. thick and 15 ft. deep, extends for a length of 216 ft. The launch was attended with all success, a very small application of hydraulic power being apparently necessary.—*The Engineer*.

Spartiate.

In most respects, the Spartiate, which was built at Pembroke dockyard and launched in October, 1898, is a copy of the Diadem, the typical ship of the class, her principal dimensions being the same, viz.: Length between perpendiculars, 435 ft.; beam, 69 ft.; mean draught, 26 ft.; and displacement, 11,000 tons. She is built of steel on the bracket-framed system, is double bottomed, and is without side armor; but her vital parts are protected by an armored steel deck 4 in. thick, which runs throughout her length, and is arched from 6 ft. below the water-line at the sides to 3 ft. above it on the middle line of the ship. In the way of the engines and boilers, this deck is carried upwards to the level of the engine's cylinder covers to give protection to the machinery.

The stem of the Spartiate is ram-shaped, and is materially strengthened by the protective deck being carried right up to the ram end and firmly secured to it. The plating of her hull bottom up to above the load water-line is also sheathed with teak 4 in. thick, and covered with sheet copper; bilge keels, 3 ft. 6 in. deep, being also fitted on both her sides. She will be steered by a balanced rudder, actuated by steering engines in duplicate of Messrs. Bow and McLachlan and Co.'s make, the controlling gear being on Messrs. Brown's telemotor principle; five of these gears being fitted for controlling the helm, from as many different stations in the ship. She will have four funnels; and two masts for signalling purposes, these having, however, no fighting tops.

The armament of the Spartiate will consist of sixteen 6-in. and fourteen 12-pounder quick-firing guns, and several smaller pieces, together with three torpedo tubes. Twelve of the 6-in. guns will be mounted in casemates on the broadsides, two will be carried on the forecastle, and two on the poop behind shields, while two of the torpedo tubes will be on the broadsides forward, submerged; and the third one right aft amidships, above the water-line.

The 18,000 indicated horse-power to be developed by the Spartiate's engines, as compared with 16,500 by the Diadem's, is not obtained by any increase in their size, or in the number of her boilers, but by giving the latter a much larger amount of heating surface, and, therefore, an increase of evaporative efficiency. The coal bunker capacity at the ship's normal load draught is 1000 tons, but provision is made for carrying an extra 900 tons if required.—*The Engineer.*

[FRANCE.]

SUFFREN.

Figaro says: "The cruiser Suffren, of 12,504 tons, the construction of which was begun on January 5 last, will be launched on July 25. Thus only six months and twenty days will have elapsed from the time she was laid down until the launch. This is the first occasion on which a vessel of this importance has been built in so short a time. The rapidity of construction of British warships which has been so often cited as an example, and which has already been beaten in the case of the Jena, constructed in 7½ months, is completely distanced by the Suffren. Eight hundred workmen have been constantly employed on the huge hull." It should be pointed out, says the *Times*, in quoting the *Figaro*, that the message does not supply sufficient information to justify the conclusions drawn from the facts stated. A ship may be launched at various stages in her construction, but she cannot properly be said to have been "built" in the sense used here until she is completed for sea. The Jena was not completed for sea in 7½ months. No French vessel has reached the British standard in this respect.—*Engineering.*

[ITALY.]

LIGURIA.

The Liguria is a well-known type of Italian vessel, a sort of small Esmeralda, with a pair of 6-in. guns fore and aft instead of a single big gun. The rest of the armament is six 4.7-in. quick-firers, and four 12-pounders, recently added, two forward and two aft on the main deck. Elswick vessels are often spoken of as being typically over-gunned; but this Liguria, though of half the tonnage and two-thirds the length of the

AVERAGE WEIGHTS OF MACHINERY AND HEATING SURFACES; "DIADEM" AND "ARGONAUT" CLASSES.

Class.	Description of Trial.	Trial.								Weights.		Surfaces.		I. H. P. per Ton (Mean I. H. P.)		Weight in Pounds per I. H. P. (Mean I. H. P.)			I. H. P. per Square Foot of Grate (Mean I. H. P.)	Heating Surface per I. H. P. (Mean I. H. P.)
		Duration.	Revolutions.	Piston Speed.	Steam Pressure. Boilers.	Steam Pressure. Engines.	I. H. P. Developed (Mean).	Air Pressure.	Coal per I. H. P. per Hour.	Machinery Complete.	Boilers Complete.	Grate.	Heating.	Machinery Complete.	Boilers.	Engines.	Boilers.	Total.		
		hrs										sq. ft.	sq. ft.							
Diadem ...	3,300 I. H. P....	30	67.9	543.8	218.5	160.5	3,339	....	2.04			1460	40,990	8.30	16.66	135	135	270	8.75	3.20
	12,500 I. H. P....	30	106.5	852.0	267.0	230.0	12,785	....	1.71	1540	767	1400	40,990	11.01	22.11	103	101	204	11.60	2.41
	Full power ...	8	116.6	933.2	286.5	236.7	16,961	....	1.73											
Argonaut.	3,600 I. H. P....	30	73.1	584.8	238.0	138.0	3,784	....	2.03			1390	47,300	8.89	17.70	127	127	254	10.02	3.39
	13,500 I. H. P....	30	112.8	901.0	260.0	220.0	13,932	....	1.66	1578	787	1390	47,300	12.05	24.17	93	92	185	13.69	2.49
	Full power ...	8	123.8	989.0	291.0	257.0	19,025	.2	1.64											

Hai-Tien, carries four 6-in. as against two 8-in., and six 4.7-in. against ten of the same caliber. She certainly does give the impression of being over-gunned, her decks are very cramped; while the two huge funnels and the superstructure about them give an idea of top-heaviness. She once carried heavy military tops, but these have been removed, and small platforms for machine guns, not very high up, have been substituted.—*The Engineer.*

[JAPAN.]

KASAGI.

The Japanese protected cruiser Kasagi was built at Philadelphia and armed at Elswick. She has an armored steel deck, 2 in. thick over the flat, and 4½ in. over the slopes, and she is of the following dimensions: Length between perpendiculars, 396 ft.; beam, 49 ft.; draught, 17 ft. 7 in.; displacement, 4760 tons; indicated horse-power, 15,500; 22½ knots' speed; two propellers; and she has cost £205,200. Her armament comprises two 8-in. quick-firing guns, ten 4.7-in. quick-firing guns; twelve quick-fire 12-pounders, and four 2½-pounder quick-firing Japanese guns in the tops. She carries five torpedo tubes, all above water, one of which is at the bows of the vessel, and twenty-five torpedoes are contained in the torpedo racks on board, as the unit for ordinary service. The bodies of these torpedoes are carried in cases or racks of steel wire netting, which is an excellent arrangement, and preserves the rudders and propellers from all possibility of accident. The extreme coal capacity of the bunkers of the Kasagi is 1020 tons. She had, however, only about 550 tons on board when we visited her, 450 tons of which had been taken in the day before in nine hours. She was fairly "light" in the water, and her full weights, except a portion of the crew, were on board. It is assumed, therefore, that her coal capacity, at normal draught, would be about 600 tons. This is good for so small a vessel.

One distinguishing feature in the Kasagi is the absence of wood everywhere; decks—excepting the upper ones—partitions of cabins, sides and treads of companion ladders, ceilings of cabins, and nearly all other features which in ships have been immemorially constructed of wood, are here found to be of steel or some other metal. The captain's saloons are ceiled with embossed steel, excessively thin and yielding to the pressure of the hand. The stamped and embossed ornaments give these apartments a very elegant appearance. The spokes and rims of the steering wheels are all of gun-metal. The men's mess tables are about the only articles which are made of wood, but the seats upon which the men sit at meals are sheet-steel boxes, with steel lids, in which their kits—mess gear, etc., etc.—are kept. To prevent discomfort, each man is allowed a little loose board to place upon the top of his box-seat. These would be heaved overboard in action. In the officers' lavatories there are capital enamelled baths, wash-stands, and other articles, but all are of metal, not a scrap of wood being observable anywhere.

The artificers' workshop is very complete, and three good-sized lathes, together with drilling machines, and other machinery, all worked by steam, are fitted; but we observed everywhere an absence of spare parts and stores. The conning tower of the Kasagi is differently constructed from those on board British war vessels. The top, instead of being removable, so as to afford a look-out all round, is attached to the sides, and horizontal slits only are left for taking observations. This is possibly a wise arrangement, for there is always a chance of the cover of our conning towers being lifted off by a blow from a large projectile. There appeared to be no voice-tube exchange stations on board. Mouthpieces of tubes, extending to almost every position, are fixed within the conning tower itself. The arrangement of anchors is curious, two being on beds upon the port side and one upon the starboard, *vice versa* to the plan on board our vessels.

The armament of the Kasagi is her remarkable feature. Whichever way we look at the question, it certainly appears an anomaly that our Niobe, of 11,000 tons displacement, should carry no weapon of even approximately equivalent potency to the 8-in. quick-firer of the Japanese cruiser of 4760 tons—assuming that the latter has been judiciously armed, which, however, is begging the whole question. The 8-in. guns, two in number, are mounted fore and aft upon the forecastle and poop, within very large and roomy steel hoods, 4½ in. thick. They are capable of containing, each, almost a whole gun's crew of the medium-sized wiry Japanese bluejackets. In rear of each gun position is the circular mouth of an armored hoist leading down to the magazines. It projects slightly out of the deck, and has a semi-spherical solid steel cap to cover it, which opens and shuts. When open the ammunition hoist is seen, which works on endless chains over a roller at the top, and runs out the cartridges—in cylinders—and projectiles, on to a loading tray. A small gun-metal tramway on the deck runs past the hoist, and from each extremity of the gun's possible arc of training. It has trolleys on it for conveying the projectiles to the various loading positions, and the lines have loops for the full and empty trolleys to pass one another.

The 8-in. gun fires an armor-piercing shot of 250 lbs., and a common shell of 220 lbs., so that the tramways and trolleys are a necessity. The gun weighs 18 tons, and the mounting 11 tons, so that the whole revolving weight is 30 tons.

The 4.7-in. quick-firing guns, which are on either broadside, have also good-sized steel shields 4½ in. thick, and are sponsoned out, so that the forward and aft pairs can point directly ahead or astern, according to their position in the ship, with an arc of training of 130 deg., whilst those between have an arc of 100 deg. of training. Of course the shields thin off towards the rear. The forward pair is casemated. Armored tubes protect the ammunition *en route* from the magazines, and a hatch, covered with an armored circular cap, somewhat similar to that employed for the 8-in. guns, surmounts the hoist for ammunition and projectiles. We should have mentioned that all the ammunition hoists are worked by electric motors, which actuate an endless chain at the side.

The 12-pounder guns have lighter shields, and they occupy intermediate positions between the 4.7-in. quick-firers, with the exception of the forward and after pair, which are within casemates of stout steel plating beneath the forecastle and within the captain's saloon respectively. The ammunition for the 12-pounders is also brought up by an electric hoist, through an armored tube, and opens by a large hatchway into a small, armor-protected square deck-house beneath the poop deck. This is an excellent arrangement for protecting the 12-pounder ammunition until it arrives on deck, and from thence it is served to the guns.

Four 2½-pounder Japanese quick-firers are in the tops. These are similar to the guns of the Takasago, already described in the columns of

The Engineer. They have large shields of a different shape from those employed in British tops, but somewhat similar to those of the broadside 12-pounders, only smaller and lighter, of course.

The unit of ammunition carried for the guns of this vessel on ordinary service is as follows: 100 rounds for each 8-in. gun, 200 rounds for each 4.7-in. gun, 300 rounds for each 12-pounder, and 400 rounds for each 2½-pounder. These units are doubled when the ship is despatched on war service. We were told that the whole of this quantity of ammunition could be carried in the magazines, but it is possible that the question may not have been fully understood. It appears a very extraordinary amount to maintain in the magazines, even in the eventualities of war.

The totals of the weights of ordinary ammunition would be as follows:

Two 8-in. quick-firing guns, 200 projectiles, say	50,000 lbs.	262,800 lbs.
Charges with metal cylinders, say	15,000 lbs.	
Ten 4.7-in. quick-firing guns, 2000 projectiles, say	90,000 lbs.	
Charges with metal cylinders, say	40,600 lbs.	
Twelve 12-pounder guns, 3600 projectiles, say	43,200 lbs.	
Charges with metal cylinders, say	18,000 lbs.	
Four 2½-pounder guns, 1600 projectiles, with charges, say	6,000 lbs.	

Or, roughly, with blank and saluting ammunition, about 120 or 130 tons. And on active service this quantity would be doubled.

The mounting and shields of the 8-in. quick-firers are rotated by electric motors, and it is said that the whole of the arc of 270 deg. could be passed over easily in one minute. Elevation is also accomplished by a small motor. These movements can, however, be carried into effect by hand and hand-gear wheels, which worked with the utmost ease and smoothness, and were in action during the occasion of our visit. The opening and closing of the breech was effected by a hand wheel between the breech and trunnion axis; four rounds can be fired in 64 seconds.

The appearance of the Kasagi did not impress us favorably. The large projecting sponsons, two heavy guns and mountings fore and aft, weighing each over 30 tons, gave us the impression of far too much topweight. Perched, as the latter were, upon the poop and forecastle, with 30 tons weight so close to the stem, and three anchors besides, to say nothing of chain cables, etc., we should say that the Kasagi would plunge and make very bad weather in a heavy sea. And the proximity of the broadside guns to one another is so remarkable that there would be hardly room to work them. It certainly does seem singular that a vessel only 400 tons superior in displacement to the Fox can carry an armament so immensely superior in weight of metal and in actual numbers, the following being a comparative statement:

FOX.	KASAGI.
Two 6-in. quick-firers	Two 8-in. quick-firers.
Eight 4.7-in. "	Ten 4.7-in. "
Eight 6-pr. "	Twelve 12-pr. "
One 3-pr. "	Four 2½-pr. "

This, too, is independent of the question of coal capacity and engine power. The Japanese cruiser is better off by 50 per cent. as regards the first item. As regards the second, there is a difference of no less than three knots in favor of the Kasagi.

Wherein, then, do these vessels differ? We believe that a solution might be found by examining the framing, scantling, double bottom, and, more than all, the skin plating of the new ships. Sir W. H. White puts down the following percentages of the whole displacement as distributed over the weights of a fast protected cruiser of this type: Hull, 38; propelling machinery and coals, 35; protective material, 16; armament and equipment, 11. But he had not in view engines and boilers working up to 15,500 indicated horse-power for a vessel of 4760 tons, or coal bunker capacity of 1000 tons, or armament and equipment, which must absorb at least 15 or 16 per cent. of the whole. Yet it is clear that if all these extraordinary weights are present, the percentage of 38 for the hull must have been seriously discounted in the designing of the Kasagi. We merely offer this as a possible solution of the enigma—for an enigma it certainly is.—*The Engineer.*

Tokiwa.

During the past week the steam trials of the Tokiwa, the second Japanese belted cruiser of 7900 tons, have been completed at the mouth of the Tyne. Her particulars are the same as those of the Asama, recently given by us, and need not be repeated now; but, shortly, she is a vessel 408 ft. long, armored with a 7-in. belt, and carries four 8-in. guns, fourteen 6-in. guns, and a number of smaller guns, and five torpedo tubes. Nearly the whole of the guns have strong armor protection, and four of the torpedo tubes are below the water-line. At her speed trials runs were made at 10, 15.6, 18.8, 21.2, and 22.73 knots, and during six hours the vessel ran at a mean speed of 20.85 knots with open stokeholds. At her last trial she ran for three hours with a pressure in her stokeholds scarcely exceeding 1½ in. at a mean speed of 23.1 knots. The engines have been supplied by Messrs. Humphrys, Tennant, and Co., and she has twelve single-ended cylindrical boilers.

Akebono.

A very successful official trial of the torpedo-boat destroyer Akebono (Dawn), built for the Imperial Japanese Navy by Messrs. Yarrow and Co., Limited, was made on March the 4th, at the mouth of the Thames. This vessel is one of six, the contract for which the Japanese Admiralty placed with Messrs. Yarrow and Co., Limited. The leading dimensions are as follows: Length, 220 ft.; beam, 20 ft. 6 in.; displacement, fully coaled and armed, about 420 tons. The model is similar to that of the Sokol, which the same firm built a few years since for the Russian Navy, but the dimensions are considerably enlarged. The type has now become one of the leading classes in the Russian Navy. The armament consists of two 18-in. swivel torpedo tubes, one 12-pounder and five 6-pounder quick-firing guns. The steam is generated by four large water-tube boilers of the Yarrow patent straight water-tube type, each with its own funnel. The propelling machinery consists of twin-screw engines of the four-cylinder four-crank triple-expansion type, capable of indicating up to 6500 horse-power with 200 lbs. pressure. The speed guaranteed by the vendors on a three-hours' continuous run, carrying a load of 35 tons, was 31 knots. Three vessels have already passed their official trials, and the contract speed has been easily obtained. When the Japanese Government have the three additional destroyers not yet tried, which are being built at Poplar, they will have a group of torpedo-boat destroyers of higher speed than any other government in the world. The details of the trials are as follows: The draught of water forward was

5 ft. and aft 8 ft. 1 in., the load carried being 35 tons. The Japanese Government was represented by Commander-Constructor M. Kondo and Constructor-Captain H. Kurobe. Six runs were made over the measured mile on the Maplin, the following being the particulars:

Number of Run.	Boiler Steam.*	Vacuum.	Air Pressure in Stokehold.	Mean Revolutions per Minute.	Time.	Speed.	Mean Speed.	Second Mean Speed.	
	lbs.	in.	in.		m. s.				
1	226	24½	1⅜	432	1 51	32.432			
							31.154		
2	226	24½	1¼	434½	2 0½	29.875		31.117	
							31.080		
3	226	24½	1½	434½	1 51½	32.286		31.143	31.159 knots
							31.206		
4	226	24½	1⅝	436½	1 59½	30.125		31.184	
							31.162		
5	226	24½	1⅝	436¾	1 51¾	32.200		31.194	
							31.226		
6	226	24½	1½	439½	1 59	30.252			

* Throttled.

Based on the revolutions necessary to make a knot, the mean speed during the three hours' continuous run was found to be 31.08 knots. The machinery throughout gave no trouble, and there was no flame visible at the funnels at any time. The weather was rather rough and a northeast wind made the sea off the North Foreland lumpy. This vessel was launched nine days prior to the official trial, and had only one preliminary run before the trial took place.—*Engineering*.

Shiranui.

The fourth Japanese torpedo-boat destroyer, Shiranui (Will o' the Wisp), recently launched from the yard of Messrs. John I. Thorneycroft and Co., Chiswick, underwent a satisfactory full-speed trial at the Maplin Sands on the 30th ult. The contractors guaranteed a speed of 30 knots when carrying a load of 35 tons, and the results obtained on the trial were 30.443 knots on the measured mile and 30.517 knots during three hours' continuous steaming.—*Engineering*.

[Russia.]

Gromboy.

The new first-class cruiser and a transport were launched on the Neva from the Baltic shipbuilding yard in presence of the Emperor, the Empress-Dowager, and other members of the Imperial family. The new armored cruiser, called the Gromboy, resembles in the main the great cruiser, the Rossia, launched from the same yard in 1896. The principal details of the vessel are: Length, 480 ft.; breadth, 69 ft.; load displacement, 12,539 tons; with engines of 14,500 horse-power. The transport ship, the Yenisei, measures 300 ft. in length and 39 ft. in breadth, with a displacement of 2600 tons, and the engines 4700 horse-power.—*Engineering*.

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MAY 5. The Naval Boiler of the Future, No. 4. Seacoast Protection.

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THE PROCEEDINGS

OF THE

UNITED STATES NAVAL INSTITUTE.

Vol. XXV., No. 3. October, 1899. Whole No. 91.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WATCH, QUARTER AND STATION BILL, "AN AID TO EXECUTIVE AND DIVISION OFFICERS."

By Lieutenant Chas. A. Gove, U. S. Navy.

INTRODUCTION.

The Board of Control, believing that a necessity existed for a new Watch, Quarter and Station Bill, has made an effort to bring up the matter for discussion in the Service, with the expectation of getting a uniform, simple, but elastic system adopted to meet the present conditions and various types of ships. To this end it requested an article from Commander Schroeder. This article appeared in the last number of the Institute and the discussions upon it appear in the present number. At the same time the Institute published in book form a scheme compiled by Lieut. Gove, which was more or less familiar to the service. In the following article Lieut. Gove explains the plan in general terms, and illustrates by inserting examples. The principal points upon which criticism and discussion are invited are in Part I, the Station Bills, and a discussion upon these is especially desired.

Very respectfully,

R. H. Jackson.
Sec. and Treas.

The book is divided for convenience into three parts.

Part I.—Contains a description of the organization, the "Watch, Quarter and Station Bills."

The stations for "Fire Quarters," "General Quarters," "Collision Quarters," "Getting Underway," "Anchoring," "Mooring and Unmooring"; also, the Battle, Boat, Battalion, and Messing Bills. Stations for Water Tight Door and Hatch Tenders.

The Berthing Bill cannot be made general, as it varies with the peculiarities of each type of ship.

Part II.—Contains forms for all routine matter.

Part III.—Memoranda.

In the Watch, Quarter, and Station Bill two additional columns are given to note any special duty, relative to the watch numbers.

To show the character of the "Blank Forms," one or more pages of each Bill of Part I are given; also a few pages of Part II and Part III.

Part I.—Organization.

The ship's complement is divided into 7 divisions. The 1st, 2nd, 3rd, and 4th constitute the Gun Divisions. The 5th the Powder and Torpedo Division. The 6th the Engineer Force. The 7th the Marine Guard. The Surgeon's and the Paymaster's Divisions will muster and drill with the 5th.

All the Divisions, excepting the 6th, are divided into 4 sections. The 1st and 3rd Sections constitute the Starboard Watch; the 2nd and 4th the Port Watch. The 6th Division (Engineer's Force) is divided into 3 sections.

The Chief Petty Officers, Yeomen, Apothecaries, Writers 1st Class, and the 1st Sergeant of Marines are designated by a letter.

Should the number of men in each Section consist of not more than 10 (the Division being 40), Petty Officers 1st Class are designated by a number of two figures. 1st Division, 11, 12, 13, 14; 7th Division, 71, 72, 73, 74. All the others of the Section have a number of three figures. 1st Division, 111, 112, &c.; 7th Division, 711, 712, &c. This would provide numbers and letters for a crew of over 300 men.

Should the number of men in each Section consist of more than 10 men, numbers of four figures would be required; Petty

Officers 1st Class to have numbers of 3 figures. 1st Division, 111, 112, &c.; 7th Division, 711, 712, &c. All the others of the Section have a number of four figures. 1st Division, 1101, 1102, &c.; 7th Division, 7101, 7102, &c. The Chief Petty Officers are still designated by a letter, and in case of more than 26 a double letter would be necessary.

Of these numbers the first signifies the Division, the second the Section, and the 3rd or 4th (as three or four figures are used) the rate in general terms of the unit of the ship's complement. (See Watch, Quarter, and Station Bill.)

One of the three Sections of the 6th Division (Engineer's Force) will be assigned each week to the Powder Division, for Battle Drill. The Section so assigned will be the 2nd relief. The corresponding number in each Section will be assigned to the same station thus: "Man 6-in. shell whip."

FIRST SECTION.	SECOND SECTION.	THIRD SECTION.
611	621	631

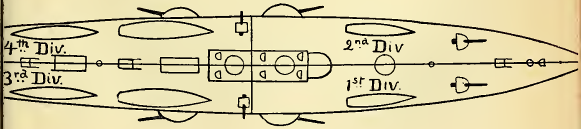
To each of the Gun Divisions there shall be assigned a "Navigator's Detail." This detail is a part of the Division in all respects, except that at Battle Drill and at "All Hands Drills" it performs the duties of the Navigator's Division. This detail consists of the Chief Quartermaster, Quartermasters, and Signal Boys. All numbers at the Gun Divisions in excess of the regular crew shall form the reserve of that Division. At Battle Drill they remain in the 5th Division, until required to fill vacancies caused by casualties. (See Battle Bill.)

The messes shall be designated as follows:

Chief Petty Officers' Mess, by letter: A, B, &c.

1st Division Mess, 11, 12, &c.; 7th Division Mess, 71, 72, &c.

The first figure signifies the Division, the second figure the number of the mess in that Division. (See Messing Bill.)



The ship is divided into four quadrants, in each of which is placed a Division, as shown by the figure above. Each Division has the care and is responsible for everything in its quadrant, from the truck to the keel. The Battery, Boats, Deck, Paint and Bright Work, Wing Passages, Funnels, Ventilators, &c. The exceptions are the Storerooms, Magazines, Torpedo, and Dynamo Rooms, which belong to the 5th Division; the spaces enclosed by the Fire and Engine Rooms, which belong to the 6th Division.

In each quadrant the work and stationing of the Division shall be divided amongst the four Sections of that Division. This may vary somewhat in different types of ships, but each Division must be kept in its own quadrant as much as possible.

In order to separate the Senior Officers in battle, the following arrangement is made:

The	1st	Watch	Officer	has	charge	of the	5th	Division.
"	2nd	"	"	"	"	"	4th	"
"	3rd	"	"	"	"	"	3rd	"
"	4th	"	"	"	"	"	2nd	"
"	5th	"	"	"	"	"	1st	"

The Officers of the Gun and Powder Divisions will station their men for all drills and exercises; then submit their Bills to the Executive Officer. In consultation with them, he will make out the Bills for the ship, tending to produce the greatest efficiency.

The Officers of the Divisions are directly responsible for the care, appearance, and efficiency of the Men, Battery, Boats, &c., in their respective Divisions.

Duty is carried on by Sections.

In port the section book shows the section respectively assigned to the call, relief, 2nd relief, and watch below.

The Section takes the call at 8 A. M., and this continues for 24 hours.

At sea the 1st Section, for example, will one day answer all calls when the Starboard Watch is on deck, and the 2nd Section all calls when the Port Watch is on deck. The next day the 3rd Section will answer for the Starboard Watch, and the 4th Section for the Port Watch.

When meals are piped the working section of the watch remains on deck until relieved by the working section of the other watch.

For any given 8 days the routine is as follows:

	CALL.	RELIEF.	SECOND RELIEF.	SECTION BELOW.
Sunday,	1	3	4	2
Monday,	4	2	1	3
Tuesday,	3	1	2	4
Wednesday,	2	4	3	1
Thursday,	1	3	4	2
Friday,	4	2	1	3
Saturday,	3	1	2	4
Sunday,	2	4	3	1

The companies of Infantry or sections of Artillery will be formed from the same Division, thus:

Company	No.	1	from	the	1st	Division.
"	"	2	"	"	2nd	"
"	"	3	"	"	3rd	"
"	"	4	"	"	4th	"

If only 2 companies can be formed, then

Company No. 1:	1st	section	of	company	from	the	1st	Division.
	2nd	"	"	"	"	"	2nd	"
Company No. 2:	1st	"	"	"	"	"	3rd	"
	2nd	"	"	"	"	"	4th	"

The Marines form a separate company or section.

Getting underway, anchoring, mooring or unmooring, those men not especially stationed shall fall in and remain at quarters. For any "All Hands" drill or manœuvre, the "Assembly" shall be sounded, and all the Divisions will go to their quarters. When "All Hands" are called to muster, the Divisions shall be marched to the point designated.

These boats will be manned as far as practicable by the Divisions in whose quadrant the boats are stowed. This crew is the "Regular Crew" and mans the boat at all times for "Landing," "Arm and Away," "Distant Service," "Cutting Out," "Abandon Ship," "Drill and Exercise." Each boat shall have a station for "Manning and Equipping," and use no other. Additional numbers will be assigned each boat for "Abandon Ship" and "Cutting Out."

Running Crews.—Every morning at 7 A. M. a list of 2 or more boats' crews, taken equally from each Division, shall be posted, and these crews will be on duty for 24 hours.

The regular Coxswain of the boat will be in charge. (See Boat Bill.)

"WATCH, QUARTER AND STATION BILL."

CHIEF PETTY OFFICERS AND SPECIAL BRANCH.			
Rate.	Name.	Division.	Remarks.
Chief Master-at-Arms.		5th	
Chief Boatswain's Mate.		1st	
Chief Gunner's Mate.		5th	
Chief Quartermaster.		4th	
Chief Carpenter's Mate.		5th	
Equipment Yeoman.		5th	
Paymaster's Yeoman.		5th	
Engineer's Yeoman.		6th	
Apothecary.		5th	
Writer, 1st class.		5th	
Writer, 1st class.		5th	
Writer, 2nd class.		5th	
Writer, 3rd class.		5th	
Schoolmaster.		5th	
1st Sergeant of Marines.		7th	
Machinist.		6th	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	
"		"	

FIRST DIVISION. FIRST SECTION.

Watch No.	Watch No.	Name.	Rate.	Gun.	Company.	BOATS.		Mess.	
						Regular Crew.	Abandon Ship.		
111	11								
112	111								
1101	112								
1102	113								
1103	114								
1104	115								
1105	116								
1106	117								
1107	118								
1108	119								
1109	B								
1110									
1111									
1112									
1113									
1114									
1115									
1116									
1117									
1118									
1119									
1120									
1121									
1122									
1123									
1124									
B									

STARBOARD WATCH.

Fire Quarters.	General Quarters.	Collision Quarters.	Clear Ship for Action.	Underway, Anchoring, Mooring.	

SIXTH DIVISION.							FIRST SECTION.	
Watch No.	Watch No.	Name.	Rate.	Boat, Abandon Ship.	Company.	Mess.	Fire Quarters.	Co Qu
611	61							
612	611							
6101	612							
6102	613							
6103	614							
6104	615							
6105	616							
6106	617							
6107	618							
6108	619							
6109	H							
6110	P							
6111	Q							
6112	R							
6113								
6114								
6115								
6116								
6117								
6118								
6119								
6120								
6121								
6122								
6123								
6124								
6125								

STATIONS.		STATIONS.		STATIONS.		STATIONS.	
ECTION "A."		SECTION "B."		SECTION "C."		SECTION "D."	
oor tch.	Watch No.	W. T. Door or Hatch.	Watch No.	W. T. Door or Hatch.	Watch No.	W. T. Door or Hatch.	Watch No.
		No.		No.		No.	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	
		"		"		"	

.—There shall be two men for each door. The Compartment will be searched as much as possible and word passed, to see that no one is
t every drill the men stationed at doors and hatches will see that the rubber gaskets, are free from paint and in good condition, that the door or
rk freely. They shall always make a report to the Division Officer, as to the above conditions.
marked * to be kept closed at night when in port.
marked ** to be kept closed when at sea.

"BATTLE BILL."

FIRST DIVISION. OFFICERS ....

No.	Gun.	Watch Nos. of Guns' Crew.	Watch Nos. of Guns' Crew.	Gun.
1				
2				
3				
4				
5				
6				
7				

Navigator's Detail........

Reserve of the Division........

SEVENTH DIVISION. OFFICERS........

No.	Stations.	Watch Nos.
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

DIVISION. OFFICERS...

orpedo.	Position.	Watch Nos. of Crew.	No.	Search Light.	Position.	Watch Nos. of Crew.
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			10			

f Magazine.	Position.	Watch Nos. Stationed.	No.	Shell Room	Position.	Watch Nos. Stationed.
			1			
			2			
			3			
			4			
			5			
			6			
			7			
			8			
			9			
			10			

FORWARD DIVISION.	AFTER DIVISION.
os..	Watch Nos..
....	....
....	....
....	....
....	....
....	....
....	....
....	....

BATTLE ORDERLIES. SEVENTH DIVISION.

No.	Watch No.	Name.	Rate.	Speaking Tube or Telephone.	Position.	Communicates with.
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

At speaking tubes and telephones; or, if cut in "action," to act as "messengers."

FOOT NOTE.—Orderlies must not press push-buttons longer than two seconds, as continued pressure causes confusion in Central Station essary, inasmuch, as the annunciator indicates station calling.

When once the Central Station has been called, orderlies must stand by tube until an answer to the message sent, when such be require

Whenever any change in the general character of the action is to take place all stations will be rung up—"attention" called upon Co and the bugle will sound "attention."

"Commence Firing," "Cease Firing" will be sounded always on bugle in addition to signal through tubes.

"BATTALION BILL."

OFFICERS.

Rank.	Name.	Boat.	Station for Equipping.	Remarks.
alion Commander				
utant				
nance Officer				
ual Officer				
ch-master				
geon				
nmissary				
ef of Pioneers				
ef Petty Officer				

COLOR GUARD.

h	Name.	Rate.	Boat.	Station for Equipping.	Remarks.

REMARKS.

COMPANY No. 1. Chief of Company..

SECTION No. 1. Chief of Section ....

No.	Watch No.	Name.	Rate.	Rifle No.
1st P.O.				
2d P.O.				
3d P.O.				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Boat..............................

Station for Equipping..............................

SECTION No. 2. Chief of Section..............................

No.	Watch No.	Name.	Rate
1st P.O.			
2d P.O.			
3d P.O.			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Boat..............................

Station for Equipping..............................

"AUXILIARIES." Chief of Company...

Watch No.	Name.	Rate.	Boat.	No.	Watch No.	Name.	Rate.	Boat.
	THE PIONEERS.					BOAT KEEPERS.		
				1				
				2				
				3				
				4				
				5				
				6				
				7				
				8				
				9				
				10				
				11				
				12				
	THE AMMUNITION PARTY.							
				13				
				14				
				15				
				16				
				17				
				18				
				19				
				20				
				21				
				22				
				23				
				24				

"AUXILIARIES."—Continued.

THE AMBULANCE PARTY.

No.	Watch No.	Name.	Rate.	Boat.
1				
2				
3				
4				
5				
6				
7				
8				

THE SIGNAL PARTY.

No.	Watch No.	Name.	Rate.	Boat.
1				
2				
3				
4				
5				
6				

REMARKS.

THE COMMISSARIAT.

No.	Watch No.	Company.	Section.	Boat.
1				
2				
3				
4				
5				
6				

COMPANY COOKS.

No.	Watch No.	Company.	Section.	Boat.
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

MESS ATTENDANTS FOR OFFICERS.

No.	Watch No.	Company.	Section.	Boat.
1				
2				
3				
4				
5				
6				

"BOAT BILL."

OFFICERS ....

atch No.	Name.	Rate.	Provides Arm and Away.	Provides Abandon Ship.

"ABANDON SHIP."

....

....

....

....

. Nos. ....

"MESSING BILL."

CHIEF PETTY OFFICERS.

	Mess No. A.		Mess No. B.		Mess No. C.		Mess No. D.		Mess No. E.		M
No.	Watch No.	Rate.	Watch No.	Rate.	Watch No.	Rate.	Watch No.	Rate.	Watch No.	Rate.	Watc No.
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

No.	Mess Chests, No.	Mess Tables.	Where Kept.	Remarks.
1				
2				
3				
4				
5				
6				

FIRST DIVISION.

No. 11.		Mess No. 12.		Mess No. 13.		Mess No. 14.		Mess No. 15.		Mess No. 16.	
	Rate.	Watch No.	Rate.	Watch No.	Rate.	Watch No.	Rate.	Watch No.	Rate.	Watch No.	Rate.

hests,	Mess Tables.	Where Kept.	Remarks.

PART II.—"ROUTINE."

"WEEKLY ROUTINE."

DAYS OF WEEK.	"ALL HANDS" TO 8 A.M. — CLEANING AND SCRUBBING ROUTINE.	FROM 8 A. M. TO NOON. — QUARTERS FOR INSPECTION AT 9.30 A. M. DRILLS, EXERCISES AND INSPECTION.
1st Monday.....	Clothes, etc.	Setting-up exercises for 10 minutes, including marching in double time. *Divisional drill. B Te a
2nd Monday.....	do. A	do. do.
3rd Monday.....	do.	do. do.
4th Monday.....	do.	do. do. Test enti plant, connec
1st Tuesday	Hammocks.	do. † Company drill at infantry, arti or bayonet exercise.
2nd Tuesday	Mattress covers. A	do. Battalion drill.
3rd Tuesday	Hammocks.	do. Company drill.
4th Tuesday	Mattress covers and bags; blankets once a quarter.	do. Battalion drill.
1st Wednesday..	Clothes, wind sails, screens, boat covers and all canvas gear as necessary.	do. Collision drill, close all watertight doors, and get out collision mat. Examine e tonator a cotton pr
2nd Wednesday..	do. A	do. and C do.
3rd Wednesday..	do.	do. Battery day. do.
4th Wednesday..	do.	do. do. do.
1st Thursday ...	Clean boats; scrub all gear and paint work.	Clear ship for action and general quarters; close battle hatches; exercise with torpedoes. Test all flood cocks; Or inspect magazines rooms.
2nd Thursday ...	do. A	General quarters; exercise with torpedoes, with incidental divisional drill. do.
3rd Thursday ...	do.	do. do.
4th Thursday ...	do.	do. do.
1st Friday......	Scrub clothes.	Setting-up exercises for 10 minutes including marching in double time. Fire quarters Fleet tactics u and sails.
2nd Friday......	do. A	do. do. Boat drill, and at D of Comd'g Offi
3rd Friday......	do.	do. do. of following: away for such
4th Friday......	do.	do. do. designated, or i of boats and ou
1st Saturday..	General cleaning day. Clean deck, ladders, gratings, mess tables, benches, chests and all bright wood work. Scrub cotton covered hose.	Inspect bags; correct clothing lists; make out Clothing Re
2nd Saturday..		Make out requisition for Small Stores. F
3rd Saturday..		Inspect bedding.
4th Saturday..		
1st Sunday	Clean ship and get ready for Sunday inspection.	Uniform—Officers, special full dress in port; dress at sea. Inspection of crews at quarters; Articles of War and Genera
3rd Sunday	do.	Uniform—Officers, dress. Ordinary inspection and general muster of officers and crew
2d, 4th Sunday..	do.	Uniform—Officers, dress. Inspection of crew at quarters; then inspection of ship.

"WEEKLY ROUTINE."

FROM NOON TO "PIPE DOWN" AT 9.00 P. M.

Afternoon Routine. ...ng-up" drill at "Evening Quarters."	
...n pulling boats with scrub crews of marines, ...and recruits; signal class instructed in [signaling.	Test electric search-lights after dark.
do.	do.
E do.	do.
do.	do.
...ll, regular crews, oars and sails; signal ...struction.	
do.	
do.	
do.	
...signal drill.	Night signals after dark.
do.	do.
do.	do.
do.	do.
	Exercise search-light.
Instruction in Signals and ...ial instruction of Engineer's Force and ...rines at Main and Secondary Battery.	do.
	do.
	do.
...gnal instruction.	Making up any omitted exercises.
do. E	do.
do.	do.
do.	do.
...ting parties.—Boat liberty, sails and oars not to land.	
do.	do.
do.	do.

A—Every night, circumstances permitting, clothes may be washed from after "colors," in such a part of the deck as may be assigned, until 8.30 P. M., when lines will be triced up and deck washed down.

B—This drill (Div.) to be as the Division Officer prefers.

C—After this drill the Carpenter will examine all the "W. T. doors" and "hatches," "air ports," "sluice gates," "manifolds," "sea connections" and "air ducts."

D—After this drill the Carpenter will examine and test all hand pumps, hose and everything pertaining to the "fire apparatus."

E—The Marines will be included in this drill, under the Marine Officer.

F—Mending Day.

* Divisional drills will consist of detail drill with Main and Secondary Battery; instruction in ordnance; in detail of, care and preservation of Battery and small arms; aiming and pointing; pistol drill, and single sticks occasionally; detail drill at stations.

1st and 3rd Mondays, serve out clean hammocks at evening quarters.

† Whenever opportunity offers the companies will be landed for dress parade and battalion drill. Men will be equipped for service on shore, occasionally, in heavy marching order.

Last Tuesday of first month of quarter inspect diving apparatus and ammunition rooms. Break out hold or storerooms if necessary.

Last Tuesday of second month of quarter overhaul ground tackle and cables.

Last Tuesday of third month of quarter test life buoys and life boats.

C Every Wednesday the Battery will be overhauled after the collision drill. At general overhauling of Battery, Divisional Officers will be present and supervise the work. Each gun with its mount, track and all appurtenances, must be put in thoroughly good condition, as required by the Gunnery Drill Book, and so reported to the Executive Officer, who will report to the Captain.

Last Wednesday of month, test dry gun cotton.

Last Wednesday of quarter, test wet gun cotton.

Third Friday of third month of quarter examination of apprentices as per Art. 868 Navy Regulations.

Saturdays—If weather is clear at "all hands," signal will be made to air bedding; later, six bells, hammocks will be piped up for the same purpose. As soon as decks are cleared up and ship inspected, pipe up bags.

On or about the 15th of each month, issue clothing and small stores.

On or about the 25th of each month, issue monthly money.

Crew will be exercised at night quarters, night fire quarters, and "man overboard," at least once every quarter. Days of the month not provided for will be utilized in making up exercises which have been omitted.

9

ROUTINE FOR SCRUBBING.			ROUTINE FOR MONEY, CLOT[illegible] REQUISITIONS.	
White Bags		on........................	Clothing Requisitions - - - -	o[illegible]
Hammocks		"	Money " - - - - -	"
Blankets		"	Serve out Clothing and Small Stores	"
Mattress Covers		"	Serve out Monthly Money - - -	"
Mess Cloths		"	Make out Conduct Classes - - -	"
Deck Cloths		"	Air Bedding - - - - - - - - -	"
Ladder	Covers.	"	Examination of Apprentices - -	"
Hose	Covers.	"	Permanent Board - - - - - - -	"
Hawser	Covers.	"	Inspection of Double Bottoms -	"
Chest	Covers.	"	....	
Gun	Covers.	"	....	
Wheel	Covers.	"	....	
Mast	Covers.	"	....	
Cots		"	....	
Boat Sails		"	....	
" Awnings		"	....	
Wind Sails		"	....	
		....	....	
		....	....	
		....	....	
		....	....	

Signals and Calls.

Emergency and General Calls.

Notify Central Station.

Sound General Alarms.

Repeat all bugle calls under forecastle and on all decks. Repeat Boatswain's calls on all decks.

Clear Ship for Action.

Boatswain's Call, "Clear ship for action."

General Quarters or Battle Stations.

General Alarm—Bugle Call—Drum.

Close Water-Tight Doors.

Siren: One long blast.

Open Water-Tight Doors.

Whistle: One blast.

Get Up Provisions.

Bugle: Provision call.

Pass the word on all decks.

Abandon Ship.

General alarm.

Bugle: Away all boats.

Pass the word on all decks.

Fire Stations.

Rapid ringing of ship's bell for fifteen seconds. Bugle call for Inspection.

Fire forward: One stroke of bell, one bugle blast.

Fire aft: Two strokes of bell, two bugle blasts.

Getting Underway, Anchoring, Mooring and Unmooring.

underway.

Secure Battery, Boats, etc., for sea	All Divisions.
Rig in lower booms	1st and 2nd Divisions.
Rig in danger booms	3rd and 4th Divisions.
Unship gangway, Starboard	Carpenter's gang and 3rd Division.
Port	Carpenter's gang and 4th Division.
For'd	Carpenter's gang and 2nd Division.
Bridge Screens	Quartermasters and Signal Boys.

Mast Covers .... Divisions.
On Forecastle .... 1st Division.
Under Forecastle .... 2nd Division.
Reeve, overhaul and lead along cat-fall.. } "B" and Stb. Watch
Hook cat and fish.................... } of 1st Division.
Tend stoppers and controllers }
Bit and unbit cable } .... 2nd Section 2nd Division.
Man cat and fish falls. All of 1st Division not stationed elsewhere.
At. steam capstan Carpenter (in charge), and Nos..............
Couple and uncouple Wild Cats..........Nos..............
Tend levers, Starboard..................Nos..............
Tend levers, Port........................Nos..............
Chain tierers, Starboard.................Nos..............
Chain tierers, Port......................Nos..............
Lead out and tend hose..................Nos..............

MOORING AND UNMOORING.

Get up clear hawse gear, bit and unbit cable, tend stoppers, range, veer, bring to and pay down cables........................ 4th Section of 2nd Division.
Shackle and unshackle chain.............Nos...............

ANCHORING.

Stand by and let go anchors..............Nos...............
Rest of crew, not otherwise engaged, remain at quarters.

Part III.—Memoranda.

Activity.

Men moving about the decks on duty shall do so on the run.

Ashes.

Will be gotten up in harbor by the Engineer's Force, and at sea by the Watch. In each case the working party will see tarpaulins laid on deck and ship's side in wake of Ash Chutes and clean up after work.

Accommodation Ladders.

Will be cleaned by the Messenger Boys or by the Divisions to which they belong.

Awnings and Curtains.

Will be stowed in............................and parts of the ship to which they belong are responsible for them.

Airing and Inspecting Beds.

This will be on.......................................
and will be aired in the parts of the ship belonging to the Divisions; all blankets will be fitted with stops.

Attention.

When a man-of-war is passing, the Bugler shall sound the "Attention Call," when every one on the upper decks and in sight will stand at "Attention" until "Carry On" is sounded.

Awkward Squad.

Those men in the Divisions who are slow, indifferent and ignorant at drill, shall form an Awkward Squad, and be drilled for one hour in the P. M. by one of the Petty Officers of the Division.

Bright Work, Gun.

Is assigned by each Division Officer.

Bright Work, Deck.

Shall be apportioned out by the Captain of each part of the ship, who is held responsible for its efficiency.

Boatswain's Mates.

Boatswain's Mates, of all rates, will carry the whistle and pass all orders and pipes in all the compartments on their decks.

Boats (See Boat Bill).

No pulling boat is to leave the ship not fully manned. In every boat's crew there is to be one who is an expert Signal Man (wig-wag); Coxswains to have a copy of "Boat Salutes." Each boat to have its recall (see signal book) painted on a tin tag, nailed in Coxswain Box, also Night Recall; Boat Box always in boat. A gong, or bell, will be struck four times at ten minutes before the regular, or extra, boat leaves; twice, two minutes before she shoves off.

Nothing but the regular boat gear is ever to be stowed in boats. At colors Boat Keepers will stand and salute; also when a man-of-war is passing. When under oars, at colors, will "toss" and salute; also when a man-of-war is passing. Under sail or steam, Coxswains rise and salute.

After Boat Drill the Officer of the Division, or those in charge of boats, shall inspect the boats for cleanliness, bright work, paint work, neatness, sails, etc., and report to Executive Officer. Those Coxswains who have an excellent boat shall have extra privileges.

Boat Box.

To be kept in the boat.

Contents of. (See page 417, Drill Regulations.)

Box, Medical Emergency.

Shall be kept in the Divisional Officer's room.

Bag Inspection.

Will take place on....................................
bags to be fitted with two stops on inside of bottom. All clothes to be marked per regulation, and lists of same taken.

Blankets.

Will be scrubbed on.................................

Buglers.

All the Buglers will sound the colors, reveille, tattoo and taps together; other calls repeated on all decks and all out-of-the-way compartments. Buglers will sleep in such a place that is most convenient for a quick call.

Bilges.

Will not be pumped out until all boats are dropped clear.

Bath Rooms and Water Closets.

For the Crew, will be in charge of

Nos. .... Starboard;
Nos. .... Port.

Bath Rooms and Water Closets.

For Wardroom, Steerage, and Warrant Officers, will be in charge of

Nos. .... Starboard;
Nos. .... Port.

They will be ready for inspection at Quarters.

* * * * * * * * * * *

"A"

INSPECTION.

1. Complement.	Officers.	Men.	Marines.
Number short.	"	"	"
No. absent from duty.	"	"	"

2. How long has ship been under present Commanding Officer?
3. When was ship last inspected and by whom?
4. Is the complement satisfactory?
5. Is the vessel clean and in good order in every department?
6. Were the officers and crew in Regulation uniform and has each man a sufficient number of suits?
7. Are medals of honor and good conduct badges worn at general muster as required by Regulations?
8. Are any suggestions offered in regard to uniform?
9. By inspection of certain bags, taken at random, is the men's clothing properly marked?
10. What is the condition of the bedding?
11. Have all books and charts, affected by notices to mariners, received since ship went into commission, been corrected? If not, give reason in detail.
12. Have the nautical books and charts given all necessary information during the cruise regarding ports and anchorages?
13. Are all station bills properly made out and are they posted in a conspicuous place?
14. Is the ship supplied with a complete set of drawings and plans and with corrected copies of the specifications under which she was built?
15. Is the ship provided with a corrected copy of the Navy Regulations and with a file of Department General Orders and Circulars up to date?
16. Are the Articles for the Government of the Navy read and posted as prescribed by law?
17. Are the instructions concerning water-tight doors and valves, and the care and preservation of the hull and double-bottoms, complied with?
18. Has the order relating to water in the double-bottoms been obeyed (Art. 1593)?
19. Are the Navy Regulations (Art. 157) in reference to saluting the flag at "colors" observed?

20. Is the ship painted as directed by Art. 1594, Navy Regulations?
21. Spar and sail exercises (such as the rig of the ship admits of, timing each evolution).
22. Are copies of Arts. 376 and 377, Navy Regulations, hung up about the ship as required by par. 9, Art. 377, and are the said Articles enforced?
23. What are the smoking orders in the ship (Art. 249, par. 10)?
24. Are the officers' messes in a satisfactory condition and conducted with fairness to all officers and according to the Regulations, are there any outstanding mess debts (Art. 249, par. 11)?

"B."

Inspection of Hull, Fittings and Outfit, Battery and Machinery.

HULL.

1. Displacement.
2. Maximum draft with maximum coal, provisions and ammunition { For'd. Aft.
3. Freeboard of spar or main deck above L. W. L.
4. Lowest air port above L. W. L.
5. When was the ship last docked, and bottom cleaned and painted?
6. What is the ship's bottom painted with and has it proven satisfactory?
7. What is the condition of the ship's bottom at present?
8. What is the general condition of the outside plating of the ship?
9. Have any structural weaknesses of hull developed since ship was last inspected?
10. Number of compartments in the ship?
11. Condition of each as to metal, paint, cement, water-tightness; undue heat, lack of ventilation, dampness and efficiency?
12. Water-tight doors.
    (a) Do they close properly?
    (b) Are edges free from paint?
    (c) Are gaskets in place and sound?

(d) Are they warped?
(e) Locks?

13. Pumping and draining. Does the drainage system of the ship work well?
14. Number and kind of pumps connected with the Pumping and Drainage.
15. Efficiency of pumps.
16. Are fire mains connected to both steam and hand pumps?
17. Where are the fire mains located?
18. Is there a diagram on board to show which valves should be turned to fill or pump out the water-tight compartments?
19. Rudder, kind? Total area? Does vessel carry any angle of helm in steering a straight course?
20. Screws. Number of blades? Condition of ? Efficiency ?
21. Are the water tanks satisfactory?
22. Quantity of water they hold?
23. What is the condition of the magazines and are they properly stowed and ventilated?
24. How are they stowed?
25. Are they properly lighted and have they any other means of lighting them than by electricity?
26. Are battle lanterns fitted with other than electric lights?

"C."

Inspection for Battle Efficiency.

MAIN BATTERY.

SECONDARY BATTERY.

(Officers in Service Dress, Crew in Working Dress, Marines Undress.)

I.—Clear Ship for Action.

1. Time required to clear ship for action.
2. (a) State what was done, and if anything was omitted.
   (b) Were all water-tight doors and valves closed, except those required for communication in action and were those ready to be closed?
3. Was the complete arc of every gun of both main and secondary batteries unobstructed?

4. Where is the station of the Commanding Officer? That of the Executive Officer? That of the Navigator?
5. Are the Commanding Officer's means of communication efficient—(a) With engines? (b) With helm? (c) With battery?
6. Are the means efficient for obtaining and signaling to each gun division the distance of the enemy?
7. Are the means of sending and receiving signals in action efficient?

GENERAL QUARTERS FOR ACTION.

8. Times in which divisions reported ready for action.

1st Division,	Commanded by	....
2nd Division,	"	....
3rd Division,	"	....
4th Division,	"	....
5th Division,	"	....
Navigator's Division,	"	....
Powder Division,	"	....
Engineer's Division,	"	....
Marine Division,	"	....
Surgeon's Division,	"	....

9. Were all the divisions properly prepared? If not state in detail defects and deficiencies.
10. How often are the rapid-fire guns mounted in cabins, cleared away?
11. Were all the equipments and spare articles supplied?
12. Were all the men of the guns' crews properly armed and equipped and supplied with ammunition?

* * * * * * * * * * *

SMOKING QUARTERS.

For Crew ....
For Chief Petty Officers ....
For Warrant Officers ....
For Steerage Officers ....
For Wardroom Officers ....

SIDE CLEANERS' GEAR.

Shall be stowed as follows:

1st Division ....

2nd " ....
3rd " ....
4th " ....

SIDE CLEANERS.

Shall be the following Nos.:
1st Division ....
2nd " ....
3rd " ....
4th " ....

STOREROOMS.

Shall be under the charge of the Yeomen of the Department to which the Storerooms belong.

TOWEL LINES.

Shall be put up in the Morning Watch, and taken down at the order "Clear up Decks for Quarters." They shall be placed for the Divisions as follows:
1st Division ....
2nd " ....
3rd " ....
4th " ....
5th " ....
6th " ....
7th " ....

WING PASSAGES.

Will be kept clean by Nos.............................
....

WATER TANKS.

After being scrubbed will be coated with cement and water.

WINDSAILS.

Will be scrubbed and looked out for by the Divisions in whose part they are located.

WATER PIPES.

Outside of the Engine and Fire Rooms the pipes shall be painted near the valves, as follows:

Sea connection . . . . Black.
Drain connection . . . Green.
Fresh-water connection . Gray.

Fire connection . . . . Red.
Exhaust connection . . Blue.

All the Carpenter's gang and Petty Officers in charge of decks shall have a copy of this system.

WASH DECK GEAR AND BUCKETS.

Will be stowed as follows:

1st Division ....
2nd " ....
3rd " ....
4th " ....

WASH CLOTHES, BLANKETS, BAGS, HAMMOCKS.

Will be stopped on as follows:............................
....
....
....
....

WARRANT OFFICERS.

At 8 P. M. they will turn in to the Executive Officer a "chit," stating what work is to be done on the next day, all the details given, and the number of men that will be required.

WORK.

All the crew shall be kept constantly at work from Reveille to 4 P. M., weather and other circumstances permitting.

WASHING WATER.

At 7 A. M. the Captain of the Hold will serve out so many buckets of water to each Division for washing. He will check off each Division as supplied, and the names of men of the Division drawing the water.

HAMMOCK NUMBERS.

On account of the different arrangement of "hammock nettings" from that of the old-fashioned ships, marking hammocks with the Watch Nos. (red and black) is no longer necessary. A good plan is to have the hammocks marked with the Pay No. of the man. The advantage of this is that a man keeps the same hammock and No. as long as he remains in the ship, no matter to what Division he may be transferred. Marked with the Watch No. (according to the present system) when he is transferred to another Division, he must either exchange hammocks (often getting a poor one in place of one that is clean and well kept), or the No. must be cut off, and a new one sewed on. As the hammock No. simply indicates ownership, the Pay No., which never changes, seems the more practical and better plan.

This system is not to be considered as "hard and fast," for it is elastic, and can be adapted to any class of ships. To the writer's knowledge one Battleship, two Armored Cruisers, and several Protected Cruisers and Gunboats use it and find it simple and effective. The principal object of this book is to have at hand a systematized plan and "blank forms" ready for use. With very little change the "forms" can be adapted to any of the different systems in use. Whether the four (4) part, three (3) part or two (2) part system on the old-fashioned Fore-Main- and Mizzentop is the best, is an open question. But it is much to be desired that some one uniform system be adopted, the reasons for which are too obvious to be discussed here.

DISCUSSION.*

Rear-Admiral FREDK. RODGERS.—The value of this excellent paper is much enhanced, as we know, by the fact that its deductions are from much practical experience gained by its author, Lieut.-Comdr. Schroeder, as the executive of a first-class battleship, in time of war as well as in time of peace.

For obvious reasons, I am in accordance with the principles set forth as desirable for the foundation of a successful and convenient organization. Having approved of them, and, in general, of the organization proposed while in command of the Massachusetts, there can be little for me to say in criticism.

As far as I am informed, there has never been imposed upon the commanding officers of modern vessels of war a uniform system of organization approved by the department. In consequence, individual ideas have prevailed in the various ships, and much labor and thought have been devoted to this matter by the progressive executives of our larger ships. Within the last three or four years, a great deal of experience has been gained in the direction, and the department is no doubt in possession of the results. Various boards have been convened to prepare for the department a uniform system of organization, but while I am not aware that any has been approved or adopted, I believe it practicable now to reach such a result successfully by comparing the various station bills

* The discussion is upon the "Watch, Quarter and Station Bill," by Lieut.-Comdr. Schroeder, in the preceding number as well as upon the above article.—*Editor.*

and combining what may "be considered the most desirable features of the best." I am now, as I have always been, in favor of parts of the ship as a basis of the organization. It remains to decide how many parts, and the nomenclature. Experience has shown that two parts subdivided are insufficient for convenience; particularly would this be the case in the latest ships, for instance the Alabama with a 6-inch battery of 14 guns, most of which are mounted in the central part of the ship.

I fully agree with Commander Schroeder on this point, and suggest the names "forecastlemen," "case-mate men," and "after guard," these three parts to be subdivided into first and second parts starboard and port, and the number in each part to be proportioned to the adjacent battery and the work required.

This division of the watches would permit at any time, if desirable, an arrangement of three watches at night, which would proportionate the large amount of work invariably required during the day.

There are three points touched upon in this article which I would emphasize as desirable.

(1) To have a general mess. No officer or intelligent enlisted man who has had experience with the old messing system and the new will question the great advantages to ship's company gained by a well conducted general mess. The commanding officer should at all times have authority to commute at least one-half the number of rations. I think indeed the old regulation which permitted the commanding officer to commute the rations at his discretion should be re-established, which would permit changes governed by various conditions surrounding a cruising ship.

While the chief petty officers should be allowed their own mess if they desire, I think that all the others should belong to the general mess.

(2) Referring to the question of firemen and coal heavers in the powder division, which always comes up and must be definitely settled, I am convinced by experience that the stations of these men at general quarters should be permanent; that they should be relieved at once if on watch and go to their regular and permanent battle stations. In exercising the powder division, it can generally be arranged to have drills without interfering with the watch on duty.

(3) The handling rooms of the main turrets being isolated from the powder division, the gun divisions of these turrets should always include the men required below for the ammunition supply, and independently of the powder division. It seems to me that the reasons for this are obvious. I can see no advantage to be gained by putting such large marine guards on board ship as is now the custom. On the contrary, as it involves an additional organization, it complicates matters. The marines, apart from their guard duties, can only at best take the place of landsmen, and the continual changes due to the large percentage of desertions from the marines detailed afloat introduce green men, and embarrass the administration of the ship.

Rear-Admiral Fredk. Rodgers.—The Board of Control in my opinion has by inviting opinions and discussions upon the subject of organization on board ship, drawn attention to a matter most important to sea-going officers of the navy. It is fair to assume that these productions will assist materially in arriving at a uniform system or organization to be adopted by the Navy Department.

With this in view Lieutenant-Commander Gove is entitled to the thanks of those interested for the work he has done in preparing his paper.

Without venturing to criticise or discuss this paper in detail, I will only state what in my opinion experience warrants me in saying, and in a general way:

First. To have the organization primarily based upon parts of the ship. The names of these parts, their number and the subdivisions to be adapted to the class of ship, her battery and interior arrangements. In the Massachusetts, two parts of the ship subdivided into first and second parts worked very well, but in the later battleships with large central battery, four parts would probably be necessary for convenience. It is to be understood that the divisions are to be in close touch with the corresponding parts of the ship so that this arrangement in no way complicates the working of divisions in complete accord with the watch bill.

Second. For obvious reasons I believe in the establishment of a general mess. This arrangement has been successfully maintained on board some of our largest vessels with the commutation of only one quarter the number of rations allowed.

Third. It has been and may now be the custom on board a number of our vessels of war to detail one of the relief watches of the engineer's force for duty in the powder division. By this means any one of the three divisions may be called upon to go to the powder division on a sudden call to quarters. I am satisfied by actual experience with both methods that this plan is not advisable and that the men should be permanently stationed for battle quarters. Should some of them be on watch they are to be relieved, of course, without delay.

Fourth. Always have a navigator's division separate and distinct from the other divisions. The only reasons advanced that I am aware of for having the navigator's division divided among the others for drill, etc., is that the navigator's time is so continually occupied that he has none to spare for drills and the ordinary duties pertaining to the care of a division. This is fully admitted, but I have always found it practicable to have the junior officer of the navigator's division, or at least some officer other than the navigator attend to these matters. In port I think the navigator is always able to give his personal attention to his division, which is at best a small one.

Captain H. C. Taylor, U. S. Navy.—Few officers will wish to question the facts which Commander Schroeder has laid before us as a result of his long and successful experience as an executive officer of a battleship. I desire to add my testimony in favor of the general or consolidated mess and to emphasize its importance and convenience in the general work of a man-of-war.

On page 339 he has some general remarks to make concerning the marines which should be answered by those who do not share his views. He speaks of "the simple, natural law of letting soldiers constitute the army and sailors constitute the navy." The history of naval organizations does not indicate that it is a natural law for sailors alone to constitute a navy. Many inconveniences doubtless result from having a portion of the crew trained as soldiers, but I believe it to be a necessity to a perfect naval organization in a time of war that a portion of the crew should have that training, and it is probable that the natural law is that which has resulted from the necessities of the case which we perceive to be in history, that there shall be a certain mixture of soldiers and sailors on board ships of war. The evolution of navies in past time indicates this.

It is proper, therefore, for one who differs from Commander Schroeder to say that there are some who would not approve of the existence of but "one uniform, one fraternity, one service." It would doubtless produce a simple and convenient state of affairs, but would not, in the opinion of some officers (myself among the number) produce the highest war efficiency.

It may be added that if we would regard the marines as permanent factors of a ship's fighting power and could rid our minds of the possibility of their being some day removed from men-of-war, we should find it easier to station them. Ways would be found and solutions would occur to us which we do not think of so long as we regard them as transients, liable to be removed from year to year by some regulation of the department or act of Congress. What may come in the future, what drawing together of the two types—the seamen and the marines—into a combination of the two in one type, we cannot tell. Such a move will be largely influenced by the reduction of fireroom forces some day, due to the introduction of liquid fuel and resulting in a large increase to the combatant element of the ship's force. But this growing together into one type is not necessary to war efficiency and the two bodies may remain as distinct as are the cavalry, infantry and artillery in land forces.

With all deference to Commander Schroeder's views I esteem it a grave error for us to advocate the abolition of marines on board ship, for I regard them as one of the elements of war efficiency of naval vessels.

Commander Wm. Swift, U. S. Navy.—Experience in our service in the organization of battleships is as yet very limited, and the attempt to draw general conclusions from such experience may lead to a serious error whereby the efficiency of organization on individual ships will be sacrificed to a system, which, however well designed, cannot in the nature of things, be equally applicable to such a variety of circumstances as we find in our different types of vessels. The efficiency of the ship should not be seriously subordinated to any system of organization in matters of detail merely for the sake of uniformity in the service. Therefore, the organization should be based on some simple arrangement easily understood by the officers and crew and readily adapted to the conditions existing on different vessels.

A most important consideration in our service is the necessity for quickly mobilizing and training a large percentage of our ships' forces in times of emergency. The available force of trained men is very small as compared with the possible demands of the navy, and in time of war with a great naval power, the necessity for absorbing and training a large percentage of raw material must be anticipated as the war progresses. These conditions make of the first importance the answer to the question "How can we most quickly commission, organize and prepare for battle, the vessels of our service?" It seems to me that a condition of first importance in this connection is that the ship's officers should have under their command at all times and under all conditions of battle service, the same group of men. My experience confirms me in the emphatic endorsement of this view.

The subdivision of the crew for ordinary ship duties into four groups, commonly called parts of a ship, under suitable titles, is a natural and satisfactory one. In addition to this, the further subdivision into two watches and two parts of each watch, so that each of the original groups will have its proportion of each part of each watch, is also natural and of great utility. Where, as at present, the usual duties of the ship at sea are alternated in watches and where, with vessels cruising and making passages under steam, the duties at night are restricted in such a way that they can be satisfactorily performed by one-fourth of the working force on deck, it is extremely convenient to have this fourth made up of men from each of the large groups so that the different duties of the ship are properly carried on by men belonging in the vicinity where the duties occur. Another advantage obtained by this system is that in the morning watch when the heaviest work of the day occurs, it is practicable to have available, three-fourths of the working force on deck without in any way impairing the efficiency of the ship at other times. Following this system, the part, whether it happens to be first or fourth, which is on duty at any time, provides lookouts and answers whatever calls may be made upon it, the alternate part only being called upon in emergencies. The method followed is probably quite familiar to many who will read this paper, as it has been frequently adopted within a few years and, from my experience, with great advantage to the general comfort and efficiency of the ship.

The present complement assigned our vessels is inadequate for several reasons. It is based upon the assumption that all men in the ship are present, fit for duty, that the demands of battle service will be of very short duration because the number of men available in the different divisions provide no reliefs for those whose duties are excessively fatiguing, nor for the casualties of an engagement. The use of the engineer's force in the powder division introduces a group of men who are a source of embarrassment for many reasons, even when, as under most favorable conditions, the same men are continually detailed for this work. The substitution of marines for men of the seamen class is an additional embarrassment in the organization, because their training and previous preparation for such duties are not so thorough, and because for this and other reasons, they are not easily transferred about from one duty to another in the same way that men belonging to the seaman branch are; in other words, they are only available for the miscellaneous duties of a ship in the restricted sense. Another emergency which is now of frequent occurrence is the detachment of groups of men from the ships for service on shore. In none of our ships can this be done without seriously crippling the fighting efficiency of the vessel.

Under these conditions, the complements of the ships should be considerably larger than at present, to provide in a satisfactory way for the various difficulties which confront the commanding officer of a vessel in the organization of his crew.

Time will not permit any extended analysis of this interesting paper which deserves the serious consideration of the naval service.

Lieutenant-Commander Marix, U. S. Navy.—In reply to your request on behalf of the Board of Control to discuss Lieutenant Gove's "Watch, Quarter and Station Bill," and inviting special criticism and discussion upon part one, I submit the following, regretting that I am not to discuss an article more in accord with my own views.

Whether or not a ship shall be worked by gun divisions, and organized with those divisions as a basis, is the principal question involved; although no one disputes the fact that the efficiency of the battery is the most important object to be attained.

To organize and work a ship by gun divisions does not add to the efficiency of the battery. It is not only necessary to have nothing interfere with the distribution of the guns on board of a ship into divisions, but it is also necessary to have nothing depend upon those divisions. Lieutenant Gove feels obliged to divide a ship's battery, no matter what the ship may be, into four divisions, and probably wishes these divisions to be almost equal in size. This would be necessary were his system adopted.

I claim that the division of guns on board of a ship is pre-eminent; it must stand absolutely alone, and nothing must interfere with it. The Bureau of Ordnance should designate how the battery of each ship is to be divided, and then the ship's authorities will station the men at the guns, having them man the guns in their own part of the ship as far as possible. In this way a ship may have three, or four, or five, or in fact any number of divisions, and the divisions may be unequal in size, yet the battery will be as efficient as it is possible to make it. Vessels of the same class will have the same arrangement, and all vessels will have the best. This would by no means be the case if Lieutenant Gove's plan of dividing every ship into four divisions were adopted. It might apply to battleships where all the turret guns and all the guns of the secondary battery are fully manned; but it could not be made to apply to cruisers of the Philadelphia and Raleigh class for instance. The Bureau of Navigation does not furnish crews for opposite guns. Nor does it seem necessary or desirable to have half of the men at the guns idle, in case only one side is engaged.

I agree entirely with Commander Schroeder in regard to dividing the ship's company into four parts. This system is applicable to every ship in the navy and has always been found perfectly satisfactory. I fail to see the use of Lieutenant Gove's system of four numbers in a watch-number. It is useless to have a watch-number stand for a lot of terms. It has been said that an officer would simply ask a man his number, and would then have all the information he wanted. It seems to me to be much simpler to ask a man what you wish to know, rather than to ask him his number and then enter into the solution of a mathematical problem.

I am opposed to Lieutenant Gove's system of having watch officers do the work of the executive; the care of the ship belongs to him, assisted by such junior officers as the detail may permit, and I see no reason why watch officers should assume that duty. Nor is it in my opinion advisable to have shifting details of men to look out below. They would take no interest in the work, and it would not be well done. On board the Maine all lower compartments and double bottoms were cared for by the berth-deck cooks and men of the torpedo division, and the result was excellent.

Regarding boats, I differ from Commander Schroeder's views, as well as from Lieutenant Gove's, but agree entirely with the former that a boat's crew should always be the same, whether for armed boats, or running boats, or abandon ship.

I am in favor of having each boat's crew composed of a number of men from each part of the ship. It is claimed by those who do not believe in this system that the same officers should always command the same men under all circumstances, a principle which seems to me to be very objectionable. In the army, where the company officers are always thrown with their own men, and with no others, this is no doubt desirable; but in the navy a division officer is also a watch officer, and when in the execution of the latter duty he is in command of all the men, and it would be better for him not to be too much identified with a certain set.

It would furthermore tend to make the ship's company itself cliquey, and instead of having three cliques (sailors, firemen and marines), as we now have, we would have seven or eight cliques on board of every ship. I therefore think it advisable to intermix the officers and men as much as possible.

The principal point to be considered after all is the care of the ship with a boat expedition or a landing party away. The ordnance instructions provide for working the battery with reduced numbers, and if necessary, men from the several divisions could be concentrated to one part. This would be better than having to send a whole division to another part of the ship and having no one familiar with that locality. For a vessel to go into action with a portion of the men away would be a very rare occurrence; but having to take care of a ship with a boat expedition or a landing party away does occur frequently, and no one can deny that a ship will be better taken care of by a reduced force all around, than by the removal of one or more whole parts of the ship, to the utter destruction of the organization.

I believe in having boats' crews manned by men from each part of the ship, and to have a boat's crew of twelve men and a coxswain a unit for the organization of the battalion, two such boats' crews making one section; and all drills, except those at the battery and ammunition, can be by sections.

I am also opposed to the abolishing of the navigator's division. There are certain men on board ship who are always in the navigator's division in action, and they should form one division. In addition to this, there can be a navigator's detail from the gun divisions, supernumeraries at the guns if possible, to work with the navigator's division as occasion requires. By this I mean men at the lead, men at the search-lights, signal boys, men to man the hand wheel in case the steam steering-gear is disabled, and all such duties as will only be required under certain circumstances.

Lieutenant Fullam, U. S. Navy.—The paper by Lieutenant-Commander Schroeder once more brings the much-discussed and long-neglected question of ship organization before the Naval Institute, and deals with the many sides of the subject in a practical and forceful manner.

It is very surprising that our "New Navy," so universally praised (even by itself), should have been in existence for more than ten years without any recognized system of ship organization. The Greer Board, and following it several other boards have at different times faithfully and laboriously formulated different schemes of organization, all of which have been buried in the archives of the Navy Department. If there has been any good reason for all this delay in the past there is none now after the experience in the Spanish war; and continued neglect to provide some uniform system will be unpardonable.

The trouble may have been that absolute perfection has been required before accepting any plan. But this is never attainable. Any system would be better than none. No system will please everybody. All officers have their personal hobbies and prejudices. Any of the systems thus far proposed, any system whatever formulated by officers detailed for that purpose, would be better for the service at large than the present plan of having as many different systems as there are ships in the navy—an extravagant concession to the hobbies of individuals, and a source of annoyance to the officers and men who are victims of such confusion.

It is by no means probable that a plan can be found that will be applicable in all respects to ships of every type. It is not desirable to attempt this. It would be far more sensible to have at least three different schemes of ship organization—the first for turret or battleships, the second for large cruisers, and the third for small cruisers and gun-boats. It would be easier for officers and men to master the governing principles of three such carefully prepared plans, than it is to learn the hundred different plans now in vogue; and with this reasonable concession to types there would be little difficulty in securing a desirable degree of uniformity in the service. The "Quadrantal" system, for instance, appeared to work well for cruisers, but a modification may be necessary for turret ships. And in the case of gunboats with few officers, the division of the ship into two parts—a forward and an after gun division—may be preferable. It is futile to attempt to organize the Machias and the Massachusetts in accordance with the same plan. This would be to carry uniformity to an absurdity.

Not having had personal experience on board a battleship, I would not venture to criticise the details of Mr. Schroeder's plans. It seems to be a most excellent one, however, and it has stood the supreme test of war, which is enough. We will never make progress in this matter till we trust somebody.

The scheme of organization prepared by Lieutenant-Commander Gove, and published by the Naval Institute, would be an excellent plan for cruisers. It also has stood the test of a thorough trial with great success, and has been worked out with attention to practical details.

Simplicity is a much desired thing in ship organization. Complications should be avoided at all times, and we should not attempt to make the watch number tell too much. The point is that the man *himself* should know his station; and he finds it difficult sometimes, particularly as regards the numerous details for boat service—abandon ship, the battalion, arm and away boats for distant service, and for cutting out. At least two of these four distinct organizations should be abolished—distant service and cutting out. For offensive work ashore or afloat, the one organization—the battalion—is quite sufficient. The circumstances of service whether "distant" or otherwise, simply determine whether the whole battalion, or any fraction of it, is needed, and how the force is to be provisioned and armed. It is absurd to have three different organizations for service away from the ship, involving the whole *personnel* and all the boats. The battalion, or part of it, is always available for any service. Here is a chance to get rid of one complication, one source of confusion.

Mr. Schroeder makes the following pertinent remarks regarding the complications introduced by the presence of marines afloat:

This subject has been previously discussed by the Institute. The majority of officers that have studied ship organization and naval training with care, and with a view solely to efficiency, have agreed with Mr. Schroeder. There are officers, however, who want the marines because they don't like "soldiering," and they say "Jacky" can't do the duty properly. But the presence of marines in small detached companies does not free the naval officer from the disagreeable duty of soldiering, nor "Jacky" from the necessity of making the attempt at it—in which he is always successful in spite of what some naval officers say about him.

If it is desirable to free the navy from soldiering—to keep our men always on board ship—a simple compromise will suffice. Let the marines of each of our naval squadrons be organized as a permanent battalion and assigned to a well-equipped transport attached to the squadron. This ship, officered by naval officers as far as may be necessary, under the orders of the Admiral, would be serviceable for any expedition, and without in any manner interfering with the fighting ships or their organization. In this way the longing of the marine "for life on the ocean wave" would be gratified, the difficulties of ship organization as pointed out by Mr. Schroeder would be removed, and naval officers would be freed from much of the soldiering of which they complain. It is the officer as a rule and not the bluejacket who makes a fuss about the work; and it is even just to say that it is the officer rather than the bluejacket who is responsible for any failure in our landing drills.

In its effect upon ship organization, it is amusing to note the manner in which the navy has put itself on record in the Personnel Bill as regards amalgamation. This much to be desired and very happy solution provides that two of the hardest worked corps in the navy, each with a distinct profession (which have always been regarded like oil and water), shall be merged, while we still have two distinct military bodies handling rifles and great guns on board ship! In other words, we amalgamated where amalgamation was difficult; we failed to amalgamate where amalgamation would have been easiest. We swallowed amalgamation butt-end first by proclaiming that a line officer could be an engineer officer also, and stultifying ourselves by admitting that the duty of a marine officer afloat would be too much for him! Mr. Schroeder shows very plainly that the process of amalgamation should be extended to the military part of the ship in order to simplify its organization. Verily, having swallowed a camel why strain at a gnat? Is it not time to recognize that this very versatile line officer is competent to wrestle unaided with the military end of the ship? When *he* is, the petty officer and bluejacket will not be found wanting.

Commander Seaton Schroeder, U. S. Navy.—When I consented to write the paper which appeared in the last number of the Proceedings, I had no idea that another officer was preparing one on the same subject; I knew nothing of this until after mine had been printed, and so some of my strictures were more pronounced upon certain points than might otherwise perhaps have been the case.

Being requested by the Secretary of the Institute to review the present article, I can only say that in my paper is to be found all in which I disagree with the able essayist; and the reasons given for my own suggestions, I suppose, may be considered as arguments against his. I may repeat here that I am not attracted to any plans which sanction the following: Not having a name to apply to a unit composed of men belonging to different divisions but working together on deck; the amount of centralization suggested in stationing men by watch numbers for every duty; having transient crews each day to man any working boats; attempting to divide the engineer's force into permanent sections presumably tallying with their steaming watches; shifting details from the engineer's branch to the powder division.

In regard to the quadrantal subdivision of a ship, it of course *can* be applied, but it does not seem to me that it can be *consistently* applied to a ship having center-line turrets, as is the case in all battleships and (alack!) monitors; certainly, parts of two divisions could not be brought into the same turret. Also, in broadside ships, carrying B. L. R.'s, in which only one side is manned—would the alternate guns' crews of, say the forward half, constitute the first and second divisions? And in that case what guns do the individual division officers command? As I said, this, of course, can be so arranged; but it would certainly result in one division cleaning ship in the vicinity of guns manned by another division, and other minor inconsistencies must frequently appear; whereas in the "old-fashioned" way, as at present applied, no incongruities can arise in any type of ship—at least that has been my experience during three years' service as executive of a 1000-ton ship, and nearly two years and a half as executive of a battleship under both war and peace conditions.

I see no advantage in the proposition to mark the men's hammocks with their pay numbers, and it is, I think, open to these objections: for convenience in piping up and piping down, and for police purposes, the hammocks of the various parts of the ship or divisions should certainly be stowed together, and no hammock stower could verify this on receiving hammocks with pay numbers on them; furthermore, the captains of parts of the ship, machinists, etc., know their men's watch numbers but not their pay numbers, and they would be all at sea at "Air bedding" and on other occasions when they would have cause to lock up a man's hammock. Also the work of the sailmaker's mate would be greatly increased, because no number has to be cut off and a new one sewed on under the present system, two permanent complete sets being always kept ready; whereas every time a new man comes on board he would get a new pay number, and it would require incessant care on the part of the sailmaker to keep his divisions' lists right.

On general principles I am always opposed to change when no material advantage is obtained. This is due not so much to sentiment as to the conviction that the fact of a method having been in force for a long time is in itself fair evidence that there is much to commend it, and it should not be lightly changed unless of a nature which brings it into conflict with new conditions and requirements. There is also no use in needlessly upsetting men's practices. The time has come when some one general system should be adopted without making it so precise and inelastic as not to be applicable to all types of ships. I think the present essayist deserves thanks for his valuable contribution, and for the pains that he has been at to present to us the result of his study of the subject.

Lieutenant-Commander K. Niles, U. S. Navy.—After about six months' experience on board the Massachusetts with the results of Commander Schroeder's views and labors in organization as set forth in his paper, it appears needless to attempt a critical discussion of an organization so thorough, adequate and satisfactory.

With the exception of the suggested assignment of the first hundred numbers to the petty officers, and the sixth, seventh and eighth, to the engineer's force, the actual organization of the Massachusetts is practically in accordance with the paper.

The division system should undoubtedly be the basis of organization in all ships of modern type and I think that it is desirable for convenience to have parts of ships, but I should not have more than two, forecastle and afterguard, which answer all requirements.

The navigator should have a separate division for the reasons set forth. It is true, however, that it is of no great importance whether it is called a division or detail.

In forming the Watch Bill, the arrangement of watch numbers as suggested commends itself as being simple and as giving all necessary information without attempting too much. The practice in several ships of using as many as four digits and indicating the watch, division, part, and individual number, etc., is also satisfactory in practice and it does not seem to be of vital importance which method is adopted, as both systems are effective.

I am inclined to favor the less elaborate one, however.

The general mess system will prove without doubt more satisfactory in the long run than the old way, but it requires careful management and close supervision to make both ends meet now that the sources of income for the mess are so much reduced. It is possible that a cruising ship would find it necessary to increase the income by means of a small assessment.

The formation of the messes should be by divisions, and ratings, and should be permanent except for firemen and coal passers, and all the messes should be in the general mess except that of the chief petty officers.

In organizing the powder division the detail proposed is admirable and I think the weight of argument is in favor of having the same coal passers go to the powder division at general quarters. The necessity of having to draw from the engineer's force is to be deplored, and it is probable that war complements in the future will provide sufficient force to fill these details otherwise.

The detail of divisions for the care of double bottoms, compartments, etc., is very satisfactory and the division officers have a routine as to cleaning, painting, inspection, etc., which enables them to make the weekly reports promptly.

The bills for collision, fire and clear ship for action, boats and battalion are most satisfactory and there is no doubt as to the desirability of adhering to the division as the basis of these bills and the rule that officers shall command the same men at all times.

As a whole I think Commander Schroeder's proposed bills and suggestions cover the ground most thoroughly; and whatever may be the system of watch numbers adopted, the fundamental principles of organization cannot vary much from those proposed.

Captain C. J. Train, U. S. Navy.—I regret that my time has been so occupied that I have been unable to give the subject the attention it deserves. So far as I can judge with a complement usually twenty-five per cent short, Mr. Schroeder's Station Bill gives entire satisfaction on board this ship. I should be sorry ever to see the old names of the parts of the ship given up, nor can I see that anything would be gained by so doing, and I should like to see the name of "waisters" given to the superstructure people.

The general mess of this ship, although in a bad way when I joined, has begun to recuperate, because it has been given special care and attention. Its success or failure depends entirely on the ability of the commissary yeoman. Here a lieutenant has it in charge, but that should not be.

One of the least of the ills arising from the stopping of the sale of beer in the canteen has been the diminution of the fund, which could be used for extra expenditure on the messes. The stopping of the issue by the Bureau of Equipment of mess gear has also a bad effect on the general mess, as the men have now to provide their own mess utensils, with the result that the mess cooks do not take that interest in the mess outfit they would take were it mess property. I hope to see the day when the general mess, so called, is established by regulation, and the commissary yeomen made a body of skilled men.

I should like to see "coaling ship" included in the Station Bill, and made a military exercise, as much as fire quarters or collision drill. Our Navy is still far behind its proper place in the performance of that evolution, if it could be so called.

With Mr. Schroeder's remarks concerning the "unfortunate heir-loom from by-gone conditions," by which I suppose he means the marines, I disagree entirely, but the subject has already been discussed sufficiently.

For Mr. Gove's book, entitled "An Aid for Executive and Divisional Officers," I have nothing but praise. Part III, "Memoranda," seems to be particularly valuable and useful.

Lieutenant W. L. Rodgers.—The paper of Lieut.-Comdr. Schroeder is a very instructive one, and the arguments command my assent in almost all particulars. But as I understand that what revivalists call a "confession of experience" is desired, I venture a few remarks.

There seem to be five principal points in the paper about which opinion may differ.

1. Whether the parts of the ship should appear in the organization.
2. What is the proper place for marines in the organization.
3. The advantages of the general mess.
4. The relation of the boat bill and landing force to the divisions.
5. The proper way of detailing parts of the engineer's force to aid in the powder division.

In regard to the parts of the ship, I served on board the Atlanta, about eight or nine years ago, when she had a crew of over 250 men organized on the old plan in use on vessels with sail power and auxiliary steam. One day the captain changed the organization to one very much like that of the Massachusetts. The plan worked very well from the first and gave no trouble in transition, for which much credit is due to the executive officer, who worked out the scheme.

The four gun divisions became the basis of the organization, and also represented the parts of the ship. The other divisions were each divided into four sections, one of which was attached to each gun division, for arm and away boats, abandon ship, battalion drill, etc. Each gun division officer organized his division, with its section from the powder and other divisions, for all duties. This plan does not seem to differ materially from that of the Massachusetts.

Marines.

I think it may be said that opinion in regard to the marines has been considerably modified by the Spanish war. The prevalent opinion before the war fully admitted the discipline and excellence of the Marine Corps, but notwithstanding this efficiency, it was generally believed that the additional strength which marines brought to a ship's complement was conferred solely by the numerical increase in the crew. The strength and thoroughness of organization on board derived no advantage from their presence.

The war effected no changes in such views, but what was very clearly exhibited in the campaign at Santiago and Guantanamo was the great advantage an admiral derives from the availability of a powerful landing party under his own orders and independent of the fighting ships. As things happened, the marines were employed in seizing and holding the absolutely essential naval base at Guantanamo. Had it been possible to place a second strong battalion in Cuban waters early in June, it is very probable that a landing force under cover of the fleet's artillery would have been able to capture the Spanish forts at the harbor mouth. Had this been done, the surrender of the city, as well as the destruction of the fleet would have been credited to the Navy alone.

Such considerations afford an indication of the large sphere of usefulness open to the Marine Corps. The political results of the late war are far-reaching, and hereafter it is probable the Navy's work will be far from home. Harmony between commanders-in-chief ashore and afloat is hard to reach, as views and responsibilities cannot be identical. Yet the fleet must secure and control its bases of operation. For such service a body of men like the marines under the orders of the Navy Department, but not necessary to the complement of the fleet, is invaluable.

General Mess.

The general mess has been a success on those ships which have tried it, but it will never be on a proper footing till the Navy Department makes it obligatory on all ships and provides proper structural accommodation for it. At present the main objection to it is that there may be a loss and waste of paymaster's stores and difficulty in keeping full stores owing to the inoperative presence on board of the old system while the new system is in use on the same ship.

The obvious remedy is to ensure the complete success of the general mess by its full acceptance on the part of the Bureau of Supplies and Accounts. The paymaster will then maintain the necessary reserve of provisions in the ship's storerooms as part of the general mess system instead of as an independent supply as at present. It seems a great advantage to have the boat and battalion bills based on the divisions, both for the sake of having the same officers and men always associated, and because it effects a certain amount of decentralization, allowing divisional officers to arrange and alter details of organization as occasion arises.

In regard to the detail of the engineer's force to the powder division, it is undoubtedly more convenient for the men and cleaner for the ship to have the detail a shifting one, and, besides, all men are exercised. I see no advantage in the permanent detail. The coal-heavers do not have important stations; they are needed only for their strength. It is easy to arrange them in groups of three, with one from each steaming watch in each group. Then if one group is assigned to each station where coal-heavers are needed, the stations are properly manned. This plan I have seen working very satisfactorily.

DEPARTMENT OF THE NAVY.

BUREAU OF NAVIGATION.

WASHINGTON, D. C., *September 21st, 1899.*

SIR:—The following is a copy of a letter received from Admiral George Dewey:

> " There has come to my notice a copy of the United States Naval Institute which contains an article by Lieutenant Carlos G. Calkins, U. S. Navy, purporting to be an historical account of the operations in Manila Bay during my command of the U. S. Naval forces there. It has not been my custom to notice the numerous incorrect accounts of those operations, nor do I desire to engage in a controversy with the writer of the paper mentioned in matters of opinion. But as the article has appeared in a publication which is understood to have the official sanction of the Department, and as it contains statements as facts conflicting with my official reports, I consider it necessary to ask that the Department will request the Naval Institute to publish in its next issue my official report of the Battle of Manila Bay, which is absolutely correct in all essentials."

The Department has directed that the Bureau communicate with the Naval Institute in regard to the above matter, and request that the Institute publish in its next issue Admiral Dewey's official report on the battle of Manila Bay.

The Naval Institute is informed in this connection that it is at liberty to use the letter of Admiral Dewey as well as this letter of the Bureau should it be deemed expedient.

Very respectfully,

A. S. CROWNINSHIELD,

Chief of Bureau.

Secretary

U. S. Naval Institute.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

OFFICIAL REPORT OF THE BATTLE OF MANILA BAY.

By ADMIRAL DEWEY, U. S. Navy.

No. 240 D.] U. S. NAVAL FORCE ON ASIATIC STATION,

Flagship Olympia, Cavite, Philippine Islands, May 4, 1898.

SIR:—I have the honor to submit the following report of the operations of the squadron under my command:

The squadron left Mirs Bay on April 27, immediately on the arrival of Mr. O. F. Williams, United States consul at Manila, who brought important information and who accompanies the squadron.

Arrived off Bolinao on the morning of April 30 and, finding no vessels there, proceeded down the coast and arrived off the entrance to Manila Bay on the same afternoon.

The Boston and Concord were sent to reconnoiter Port Subig, I having been informed that the enemy intended to take position there. A thorough search of the port was made by the Boston and Concord, but the Spanish fleet was not found, although, from a letter afterwards found in the arsenal (inclosed with translation), it appears that it had been their intention to go there.

Entered the Boca Grande, or south channel, at 11.30 p. m., steaming in column at distance at 8 knots. After half the squadron had passed, a battery on the south side of the channel opened fire, none of the shots taking effect. The Boston and McCulloch returned the fire.

The squadron proceeded across the bay at slow speed, and arrived off Manila at daybreak, and was fired upon at 5.15 a. m. by three batteries at Manila and two near Cavite and by the Spanish fleet anchored in an approximately east and west line across the mouth of Bakor Bay, with their left in shoal water in Canacao Bay.

The squadron then proceeded to the attack, the flagship Olympia, under my personal direction, leading, followed at distance by the Baltimore, Raleigh, Petrel, Concord and Boston, in the order named, which formation was maintained throughout the action. The squadron opened fire at 5.41 a. m. While advancing to the attack, two mines were exploded ahead of the flagship, too far to be effective.

The squadron maintained a continuous and precise fire at ranges varying from 5000 to 2000 yards, countermarching in a line approximately parallel to that of the Spanish fleet. The enemy's fire was vigorous, but generally ineffective.

Early in the engagement two launches put out toward the Olympia with the apparent intention of using torpedoes. One was sunk and the other disabled by our fire and beached before an opportunity occurred to fire torpedoes. At 7 a. m. the Spanish flagship Reina Christina made a desperate attempt to leave the line and come out to engage at short range, but was received with such galling fire, the entire battery of the Olympia being concentrated upon her, that she was barely able to return to the shelter of the point. The fires started in her by our shell at this time were not extinguished until she sank.

At 7.35 a. m., it having been erroneously reported to me that only 15 rounds per gun remained for the 5-inch rapid-fire battery, I ceased firing and withdrew the squadron for consultation and a redistribution of ammunition, if necessary.

The three batteries at Manila had kept up a continuous fire from the beginning of the engagement, which fire was not returned by this squadron. The first of these batteries was situated on the south mole head at the entrance to the Pasig River, the second on the south bastion of the walled city of Manila, and the third at Malate, about one-half mile further south. At this point I sent a message to the Governor-General to the effect that if the batteries did not cease firing the city would be shelled. This had the effect of silencing them.

At 11.16 a. m., finding that the report of scarcity of ammunition was incorrect, I returned with the squadron to the attack. By this time the flagship and almost the entire Spanish fleet were in flames, and at 12.30 p. m. the squadron ceased firing, the batteries being silenced and the ships sunk, burnt, and deserted.

At 12.40 p. m. the squadron returned and anchored off Manila, the Petrel being left behind to complete the destruction of the smaller gunboats, which were behind the point of Cavite. This duty was performed by Commander E. P. Wood in the most expeditious and complete manner possible.

The Spanish lost the following vessels:

Sunk.—Reina Christina, Castilla, Don Antonio de Ulloa.

Burnt.—Don Juan de Austria, Isla de Luzon, Isla de Cuba, General Lezo, Marques del Duero, El Correo, Velasco, and Isla de Mindanao (transport).

Captured.—Rapido and Hercules (tugs) and several small launches.

I am unable to obtain complete accounts of the enemy's killed and wounded, but believe their loss to be very heavy. The Reina Christina alone had 150 killed, including the captain, and 90 wounded.

I am happy to report that the damage done to the squadron under my command was inconsiderable. There were none killed, and only 7 men in the squadron very slightly wounded. As will be seen by the reports of the commanding officers which are herewith inclosed, several of the vessels were struck and even penetrated, but the damage was of the slightest, and the squadron is in as good condition now as before the battle.

I beg to state to the Department that I doubt if any commander-in-chief, under similar circumstances, was ever served by more loyal, efficient, and gallant captains than those of the squadron now under my command. Capt. Frank Wildes, commanding the Boston, volunteered to remain in command of his vessel, although his relief arrived before leaving Hongkong.

Asst. Surg. C. P. Kindleberger, of the Olympia, and Gunner J. C. Evans, of the Boston, also volunteered to remain after orders detaching them had arrived.

The conduct of my personal staff was excellent. Commander B. P. Lamberton, chief of staff, was a volunteer for that position and gave me most efficient aid. Lieut. T. M. Brumby, flag lieutenant, and Ensign W. P. Scott, aid, performed their duties as signal officers in a highly creditable manner. The Olympia being short of officers for the battery, Ensign H. H. Caldwell, flag secretary volunteered for and was assigned to a subdivision of the 5-inch battery.

Mr. J. L. Stickney, formerly an officer in the United States Navy, and now correspondent for the New York Herald, volunteered for duty as my aid, and rendered valuable service.

While leaving to the commanding officers to comment on the conduct of the officers and men under their commands, I desire especially to mention the coolness of Lieut. C. G. Calkins, the navigator of the Olympia, who came under my personal observation, being on the bridge with me throughout the entire action, and giving the ranges to the guns with an accuracy that was proven by the excellence of the firing.

On May 2, the day following the engagement, the squadron again went to Cavite, where it remains. A landing party was sent to destroy the guns and magazines of the batteries there. The first battery, near the end of Sangley Point, was composed of two modern Trubia B. L. rifles of 15 centimeters caliber. The second was a mile further down the beach, and consisted of a modern Canet 12-centimeter B. L. rifle behind improvised earthworks.

On the 3d the military forces evacuated the Cavite Arsenal, which was taken possession of by a landing party. On the same day the Raleigh and Baltimore secured the surrender of the batteries on Corregidor Island, paroling the garrison and destroying the guns.

On the morning of May 4 the transport Manila, which had been aground in Bakor Bay, was towed off and made a prize.

Very respectfully, your obedient servant,

GEORGE DEWEY, *Commodore, U. S. N.*,
Commanding U. S. Naval Force on Asiatic Station.

The SECRETARY OF THE NAVY, *Washington, D. C.*
(Bureau of Navigation.)

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ARCTIC OCEAN
Arctic Circle
NORTON
NOTE
The area distinguished by a reddish tint represents the extent of the explorations by the U. S. Naval Expedition under the command of Lieutenant George M. Stoney, U. S. Navy.
The routes to St. Michael and Pt. Barrow explored by the same expedition are indicated thus

180°
140°
A R C T I C O C
Herald I.
Demarcation Pt.
C. Serdze
East Cape
Rudder Bay
C. Bering
Preobrashenia Bay
Kayne I.
Indian Pt.
King I.
West C.
N.E. Cape
East Cape
S.E. Cape
C. Chitnak
Rat Lake
Lower Ramparts
70°
68°
66°
64°
62°
NOTE
The area distinguished by a reddish tint represents the extent of the explorations by the U. S. Naval Expedition under the

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EXPLORATIONS IN ALASKA.

By George M. Stoney, Lieutenant, U. S. Navy.

INTRODUCTION.

In submitting the following pages the writer disclaims any idea of attempting to write a book. His object is to give, in narrative form, an account of the experiences and observations made by himself and the officers of the expedition sent under his command, by the Hon. Secretary of the Navy, Wm. E. Chandler, to explore Putnam, or Kubuck, Rivers, discovered by the writer, and the country in Arctic Alaska, north of it—a section never before visited by the white man.

The hearty willingness, intelligence, energy and efficiency of the officers and men composing the expedition enabled him to cover a much greater extent of country than was at first contemplated.

A full report of the exploration was submitted to the Hon. Secretary of the Navy on the return of the expedition, some ten years ago. It was highly approved and sent to Congress, accompanied by a strong letter from the Secretary of the Navy, urging its immediate publication, as the data were of special value. Congress ordered the report printed. In some way the papers have mysteriously disappeared.

It may seem to some rather late for this publication, but since the country is still unknown to the public, and the writer has received so many inquiries on this subject, both from those interested in Alaska and those expecting to visit the country, he submits this for two purposes: 1st, to give those who were the pathfinders the credit for their hard work, endurance and suffering; 2nd, it may be of interest to some and prove of more value to those visiting the country.

I.

My first visit to northwestern Alaska grew out of my connection with the U. S. Arctic Relief Ship Rodgers, which was sent to the Arctic Ocean in search of the Jeannette Expedition, under Lieut. De Long, U. S. N. The story of the sufferings and hardships of the party, and the loss of that ill-fated ship is well known, as is the manly heroism displayed by the officers and men, of which every American may well be proud.

The natives of the vicinity of the disaster were specially kind to the destitute officers and men, supplying many of them with clothing, and sheltering and feeding all hands through a severe arctic winter until relief came in the spring.

To reward them for their kindness, Congress, the following year appropriated a sum of money to buy presents for them, and as one of the officers of the vessel I was detailed to make the distribution of the same.

I took passage from San Francisco in the spring of 1883, in the U. S. Revenue Cutter Corwin, Captain M. A. Healy, U. S. R. M., with the presents on board. We arrived at St. Lawrence Bay in July, and the distribution was soon after made.

As the Corwin was bound further north, and I could not get south until her return, I determined to employ the intervening time in looking for a large river reported by the natives as emptying into Hotham Inlet, an opening of Kotzebue Sound, Northwest Alaska. The report of the existence of such a river is mentioned by Captain Beechey, R. N., who surveyed these coasts in H. M. Ship Blossom, 1826-27, but as far as known, no white man had ever visited it.

Steaming across to the American side, the Corwin left me on a sand-spit, near the mouth of Hotham Inlet, with the "dinghy," one white man, Tucker, Miunuck, a native from Norton Sound, and provisions for seven days. She then proceeded on her cruise.

I secured the services of another native, Ounalana, from a village near by, and started to search for the mouth of the river. We reached a stream after two days' hard work, and were soon lost in the intricacies of what proved to be an extensive delta.

Master C. F. PUTNAM.

After eight days of extreme hardship, pulling about sixteen hours each day, and being nearly devoured by the mosquitoes,* we made the head of the delta, forty-five miles from the coast or outlet. The main stream, which fed the several delta channels, had every indication of being what was reported—a large river. We worked our way some forty miles further up, when we were compelled to turn back for lack of time. We had but seven days' supply of provisions to start with, and beyond that had to depend upon what the country afforded, and I to meet the Corwin at the time agreed upon. Fifteen days after leaving me, she picked me up again at the same place, and started south. I reached San Francisco October 8th.

I reported my discoveries to the Honorable Secretary of the Navy, Wm. E. Chandler, and requested that I be ordered to make further exploration of the stream, stating that I was the *first white man* to visit it, and I believed that it would prove to be an excellent highway into the heart of Arctic Alaska. I also suggested the name of "Putnam" for this river, in honor of Master Charles F. Putnam, United States Navy, the officer of the Rodgers, who lost his life while gallantly trying to aid his imperiled shipmates.†

My request was granted and the schooner Ounalaska, of forty-nine tons, was ordered to be fitted out for the trip, with six months' provisions and stores. Later, a twenty-eight foot navy steam cutter was added to the equipment, and $200 worth of articles suitable for trade with the natives. The vessel was put in commission March 18, 1884, and I assumed command. Her crew consisted, besides myself, of Ensign J. L. Purcell, Gunner Cushman and eight men, with Dr. Reed of San Francisco, who shipped as "apothecary," in order to accompany the expedition.

The following order was received:

NAVY DEPARTMENT, Washington, D. C., April 1, 1884.

SIR:—The Ounalaska having been fitted out for the purpose of carrying a party to Hotham Inlet to make an examination of the river emptying

* See note on "Mosquitoes" in the continuation of this paper in No. 92 of "Proceedings."

† In substituting others for the long native names of the rivers and lakes; also in naming mountains, I have chosen those of men who have advanced or done Arctic exploration.

into that inlet, reported by you to the Department in November last, you will, when in all respects ready, proceed to sea with the vessel under your command and make the best of your way to Hotham Inlet.

You are authorized to touch at such ports between San Francisco and your destination as you may deem necessary.

While it is desirable to obtain information in relation to that portion of Alaska, its resources and its inhabitants, you are directed to so regulate your actions as to not only give the latter no cause for offense, but, on the contrary, to endeavor, by courtesy and kind treatment, to impress them with the interest which the Government represented by you has in all its people.

The log-book of the Ounalaska will be carefully kept in conformity with the instructions from the Bureau of Navigation, and, in addition, you will keep a journal or remark book of the cruise, which you will embody in a report upon your return to San Francisco.

You will arrange your movements so as to arrive with the Ounalaska in San Franscisco not later than the 1st of November next, and you are not to extend your examination of the river and the surrounding country to such length as to prevent you from complying with this part of your instruction.

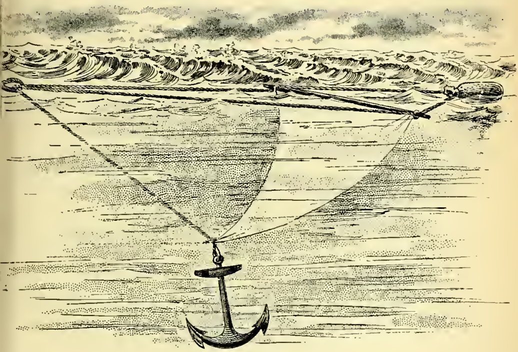
Very respectfully,

W. E. CHANDLER, Secretary of the Navy.

Lieutenant Geo. M. Stoney, U. S. N., Comdg. U. S. schooner Ounalaska, Navy Yard, Mare Island.

In accordance with the above the Ounalaska sailed from San Francisco April 13, 1884, and reached Ounalaska May 20. The passage up was very rough. One gale of unusual severity was successfully weathered by the use of a drag and oil, in a way that it may be well to explain. A triangular sail with a drop of six feet was lashed to the steam cutter's mast, and a seventy pound anchor was hung by a short line to the opposite end of the sail. From the three corners of the sail, lines were led, forming a bridle, and to this bridle a four inch hawser was made fast. A regulation canvas bag three-fourths filled with lard-oil was slung by a span from the end of the mast, so as to ride opposite the center of the spar. The mouth of the bag was sewed up, the sides were irregularly punched with numerous sail-needle holes, the whole apparatus was put over the weather bow and sixty-five fathoms of line were veered to it. It trended three points off the bow and kept the schooner within three or four points of the wind. The motion of the waves, working the bag, caused the oil to squirt out of the needle-holes, and it so smoothed the heaviest combing seas that they reached the vessel more like ground swells than the waves of a heavy gale. The schooner at the time was under a close-reefed triangular mainsail.

We remained at Ounalaska rating our chronometers until May 27th, when we left for the Bogoslof Island, some fifty miles westward, to inspect the new volcano reported to have recently begun action. I made extended investigations of the volcano and vicinity, a report of which was sent to the Smithsonian Institution, with a number of specimens, land and marine, which were collected.* We then stood northward, running a line of soundings,



DRAG WITH OIL-BAG.

till we met heavy ice, twenty miles south of St. Matthew's Island, when we turned to the eastward.

While standing eastward the character of bottom indicated the presence of a codfish bank. We hove to, got out lines, and in a few hours caught enough codfish to supply all hands for three weeks, besides salting down a couple of barrels for future use. They were of excellent quality, weighing from thirteen to seventeen pounds apiece, and so numerous as to justify the conclusion

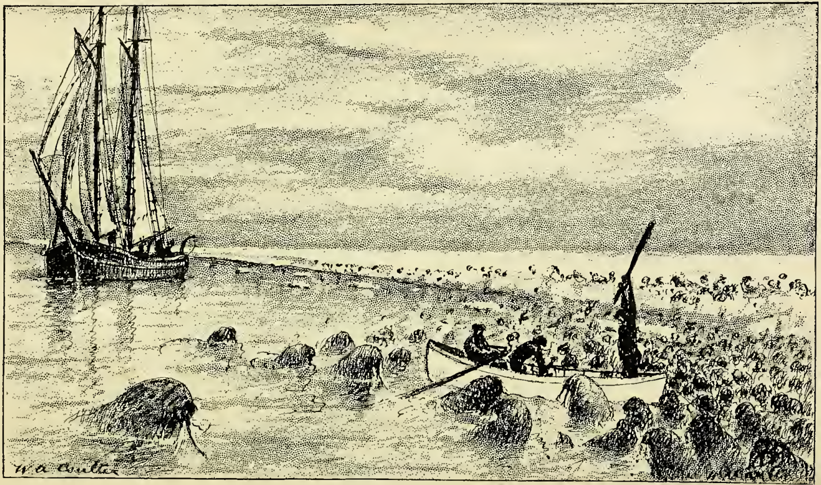
* Notes on Volcano Sinking.

that I had struck a regular cod-bank—a fact worthy of mention, as it was generally held that these fish do not get so far north. This bank extended from long. W. 168° 45′ to Nunivak Island, between the parallels 60° and 60° 22′ N.

After establishing the geographical position of the west end of Nunivak Island, which had been charted ten miles too far to the east, we stood away on June 13th, for St. Michael's, the chief port of the Alaska Commercial Company. Their Agent, Mr. Lorenz, and his assistant, showed us every kindness. I here engaged an interpreter, Aloka, the offspring of a Russian serf, and a Norton Sound native, Unga-look, who was nicknamed "Riley" on account of his having but one eye, as a guide.

On June 23rd, we started for Bering Strait, and as the ice was well to the southward we stood along the American coast, which was reported clear by the natives, but on June 27th were headed off fifteen miles north of Sledge Island. The many walruses on the ice showed that its strength was too great for forcing our way. Wishing to get a walrus specimen for the Smithsonian Institution, I left the schooner in the "dinghy" with the Doctor and one man, pulled over about half a mile and landed on the ice. Picking out the best specimen, a large male animal, I shot it, and started towing it off to the vessel. While doing so, we were attacked by a school of a hundred or more walruses. They would strike under the boat and rise all around, trying to get their tusks over the gunwale. It became a fight for life. We stood up in the boat and fought them off with boat-hooks and oars. As is generally the case on such occasions when a rifle is most wanted, I could not get hold of mine as it was in the bottom of the boat, under other articles. The fight lasted only a few minutes, but it seemed like a lifetime, until the rifle could be gotten out. One shot frightened them all away, but they were not half so frightened as were those in the boat. To be in a small boat with the water alive with walruses, the blowing of the animals causing the water to foam, and to hear that terrible sound that only a mad walrus can make, is calculated to cause any one's hair to stand on end.

The walrus was gotten aboard the vessel and skinned. The flesh was kept for the natives in St. Lawrence Bay. I knew what we would have given for some fresh walrus meat during our stay with them when the Rodgers was burned. The stomach and



A FIGHT WITH WALRUSES.

intestines were examined for specimens. Seventy-eight feet of the latter were measured and examined, and there was found altogether, only a double handful of pebbles ranging from the size of a pigeon's egg to that of a pea. This surprised me for I could not see how these animals existed. The walrus always follows the ice, keeping on the edge. The natives claim that they live on mussels and clams which they dig with their long tusks from the bottom, in shoal water, and that when the ice works down into deep water during the winter, they have to live on their fat, like the bear. To check their hunger they swallow these pebbles which keeps something in their stomachs. That often they become so poor that they swallow a lot of these pebbles to aid them in diving. I afterwards examined many walruses' stomachs and intestines, finding mussels and clams, but in no case fish. The fact that the walrus is much fatter in the fall than in the spring proves they must get more food in higher latitudes, than they do when they go south with the ice in the winter. I think, however, that the pebbles get in their stomachs when they are swallowing the mussels.

The walrus as food is not bad, especially the flippers, which, when boiled taste not unlike pigs' feet. A young walrus's hind quarter makes a very good roast, unlike the seal which has a rank taste. The liver of the walrus is good, and frozen walrus was much sought after by the Rodgers crew during their stay in Siberia.

Heading to the westward we worked along the edge of the ice, and on June 30th made St. Lawrence Bay, Siberia. The inner harbor, where the Rodgers was lying when burned, was still closed with ice, so we anchored off Cape Nuniagmo, an excellent place for watering ship, and there learned from the whalers that Kotzebue Sound was full of ice, and there was no hope of getting into Hotham Inlet for a time.

A gale coming on from the southward, we got under way and stood clear of the land for ten miles and lay to, heading to the southward and eastward. A dense fog set in which lasted thirty-six hours; when it lifted I found the schooner had drifted forty miles to the northward, through Bering Strait into the Arctic Ocean. For forty-eight hours I tried to beat back but could not do so on account of the strong current setting through the strait. July 3rd, we came to anchor under the lee of East Cape, Siberia, where we found the whale ship Ohio, of New Bedford, Captain Ellis, master, who kindly gave me three hundred and sixty gallons of fresh water. The next day we stood over towards the American side. In latitude 66° 04′ N., longitude 168° 17′ W. we met heavy ice which had to be worked through to get to the shoal water where it could not close in on the schooner. Thick weather prevented observations until July 9th, when the land was made, about forty miles to the southward and westward of Cape Espenberg, and a lead enabled me to stand along the shore and across Kotzebue Sound to the mouth of Hotham Inlet, where I came to anchor July 10th.

Sounding out and temporarily buoying a channel over the bar, a mud and sand-bank about one thousand yards wide with eight feet depth on it at low water, we crossed over. At high water, and when the wind is from the southward and westward, two fathoms can be carried over. Winds from northward and eastward give the least depth. After crossing, a depth of three fathoms was carried in the channel for twenty miles, increasing in places to seven fathoms. Ten miles up the inlet we came to anchor off the lowest native settlement on the inlet. The village was much the same as when visited the preceding year. Having made all necessary arrangements for guides, we began working up the inlet. The wind being light, the current strong and the pilot ignorant, the Ounalaska went hard and fast aground. We laid out both anchors, hoisted out the steam cutter, and after eight hours of hard work floated again in three and one-half fathoms of water. I put the steam cutter in running order and decided to leave in her at once to explore the Putnam River. The following orders were given Ensign Purcell:

U. S. Schooner Ounalaska,
At Anchor, Hotham Inlet, Alaska, July 16, 1884.

Sir:—On my departure from this vessel you will take command. The following are your instructions during my absence: As soon as the wind is favorable you will take the vessel to the mouth of the Putnam River and there await my return. You will, as soon as possible, land in a secure place near the vessel three months' stores. You will take especial care to avoid fire aboard the vessel, inspecting the hold, all lights and fires frequently. Should fire break out and gain hopelessly on you, land everything as soon as possible; better scuttle the vessel than let her burn up. Burn wood instead of coal in galley and stoves. The log will be kept as directed by the Bureau of Navigation. Establish the latitude and longitude of the mouth of the Putnam River, and measure a base line. Measure the mouth of the river as accurately as possible. Take accurate tidal observations, amount of current, rise and fall, etc. Get all the information you can that will be of use to the Department. Be specially careful to avoid any difficulty with the natives. When they visit the vessel give them small presents. Use persuasion and do not use force unless actually necessary to save the vessel and lives of the crew. This you cannot be too careful about.

I will probably be back by September 1. Should anything happen me you will take the vessel back to San Francisco, Cal., and report to the Department, leaving Hotham Inlet not later than September 15, and reaching San Francisco by November 1. By no means remain longer than September 15 without further orders, though you leave me behind. Touch at such ports as you deem necessary. At Ounalaska you will get chronometer ratings and caulk the vessel. While I am away you will make all necessary repairs on the vessel that can be done.

Accept my warmest thanks for the deep interest you have taken in this cruise, and my gratitude for the aid you have given me in carrying out, so far, my plans.

Very respectfully,

GEO. M. STONEY, Lieut., U. S. N., Comdg.

Ensign J. L. Purcell, U. S. Schooner Ounalaska, Hotham Inlet, Alaska Territory.

On July 16th I left the Ounalaska, in the steam cutter, with the "dinghy" and a six-ton skin-boat in tow. The expedition consisted of myself, three of the crew, Aloka the interpreter, four natives, and outfit and provisions for forty days.

The first day only ten miles were made when camp was pitched on Nimyuk sand-spit so as to get wood. There were here a few deserted huts which I wished to use as fire-wood, but objections were made by the natives, who protested that their destruction would cause the death of the former occupants. This was inconvenient, for the driftwood on the spit was poor and proved very unsatisfactory—steam could not be kept up with it for any length of time. It made a strong, quick fire, but gave little heat, and in three hours a boatload would be consumed, necessitating frequent stops to replenish, which was hard work, for often it had to be carried on the back a quarter of a mile, and the mosquitoes were so annoying as to interfere with work. The next day we went on, and towards evening it blew fresh from the east, causing a lively sea to run, that came over the launch and nearly extinguished the fires; so we made sail and ran for the beach, bailing to keep from swamping. Making the lee of a sand-spit, we landed and went into camp to await better weather, where we remained, the following day making repairs. I covered all the steam pipes with sheet lead and the exposed parts of the boiler with fire-clay and mud. This jacketing proved of much service, preventing radiation, and enabling steam to be kept up. The deserted huts at this camp were used for fire-wood, the natives preferring to sacrifice their superstitions rather than carry wood long distances. July 19th, entered the mouth of the Putnam River, and camped on a small creek.

From July 20th to August 13th was spent in going up the river in the steam cutter. After ascending about two hundred and seventy-five miles, the current became so strong, and the sounding out a channel in the low river so tedious, that I left the cutter in charge of the machinist, and proceeded in the skin boat. Having tried paddling with poor results, I resorted to "tracking," dividing the party into two crews, myself leading one, and my best man the other. Turns were taken on the drag, a forty fathom seal-skin tow-line made fast to the boat one-third the distance from the bow, with three loops at the other end fitting around the shoulders and under the armpits. This mode of traveling was kept up twelve hours a day for five days, until the Su-look-pow-vuck-to-ark river was reached, when the men became exhausted from the hard work. All suffered from sore feet, caused by walking over rocks and stones. Six miles before reaching the above stream the tracking was through rapids, with a current from six to seven knots, setting around and over many large boulders, among which one fathom of water was carried.

I learned from natives that the Putnam had its rise among several large and extensive lakes. As one of them on the north side was said to be near, I left the skin boat and crossed the country to visit it, taking with me one of the crew, the others being yet unable to travel, and four natives carrying a canoe, four days' rations, blankets, oilskins, sextant, compass, a shotgun, two rifles and ammunition, each person having about thirty pounds' pack. After a fatiguing journey of one day we arrived at the lake, which I named Lake Selby. I crossed it in the canoe, sounding as I went, and finding no bottom at eighteen fathoms.

I ascended the mountains on the north side of the lake and determined the latitude by meridian altitude of the sun, and the

TRACKING UP PUTNAM RIVER.

height by barometer. As my camp on the river was visible from the mountain, I located it by bearings; also the position of the lake. This lake abounded in fish—I was told they were of the salmon species and very large—some of them measuring six feet. The peculiar features of the shore and islands indicated a glacial formation.

Completing my observations, I returned to the boat and decided on starting back to the schooner, as the season was getting late and my orders from the Department were positive. This I did reluctantly, as everything was favorable for the further prosecution of the work.

The month of July was one of incessant rain, and as the party was exposed all day and sometimes at night, we found it extremely unpleasant. On the 24th there occurred a thunder-storm of extraordinary violence. The thermometer suddenly fell 9°F., and the barometer rose .15 in.; hailstones two inches in circumference fell for twenty-five minutes; the rain poured down in torrents; forked lightning flashed vividly and unceasingly; and the roar of thunder was incessant and deafening. During the storm the wind was from the northward. Then it fell calm and remained so for a time, and at its termination came from the southward. The temperature of the water that fell was 38° Fahr. During August no rain fell. The heat of the sun was powerful, ranging from 80° to 100°F. during the middle of the day, while at the same time in the shade it was from 60° to 70° F. The greatest heat was 110° F. No especial inconvenience was felt from these exposures. Sunset was followed by a rapid fall in temperature and heavy dew. Towards midnight it became cold and frost formed, and sometimes thin ice made on small, still pools. Returning down the river, it was noticed that the water had fallen, exposing numerous sand-banks. This low water the natives attributed to there being no rainfall in August.

After reaching the schooner, finding that I had a week to spare, having made the descent so rapidly, I determined on exploring Selawik lake. Ensign J. L. Purcell was detailed for the work and given the following orders:

U. S. Schooner Ounalaska,
Hotham Inlet, Alaska Territory, August 22, 1884.

Sir:—You will take charge of the steam cutter Helena, and with a crew of four men—C. J. Huebner (M. A.), Wm. Ready (Mach.) and two

Indians, and rations for seven days—proceed without delay to Selawik Lake. Explore said lake and the mouths of the different streams that flow into it.

You will not remain longer than six days from this vessel. If the work cannot be done in that time, return immediately. If Selawik Lake prove to be of little extent, and the work can be done in forty-eight hours, you will extend your triangulation on Putnam River as far as the third outlet.

You will keep a regular log during your absence, and, in addition, keep accurate notes of all you see—natives, country around lakes, etc. In fact, find out all you can that will be of interest to the Government.

Since it is reported that there is no driftwood in Selawik Lake, nor timber on its banks, you will take with you five hundred pounds of coal and use it with the driftwood you get at the mouth of Putnam River before entering Selawik Lake.

Should the water in Hotham Inlet fall to any extent while you are away, I will drop the schooner down to the mouth of the inlet, where you will join me.

On your return report in writing what you have seen and done.

Very respectfully,

Geo. M. Stoney, Lieut., U. S. N., Comdg.

Ensign J. L. Purcell, U. S. N., Hotham Inlet.

During Ensign Purcell's absence stores were stowed on board and all preparations made for leaving. A supply of driftwood gotten for the galley, so as to save the coal for the steam cutter, proved of good service, for the cutter was constantly used to tow the schooner, and only a little wood is found in the lower part of the inlet. Ensign Purcell returned August 26th, and submitted the following report:

Lieutenant Geo. M. Stoney, U. S. N., Commanding U. S. Schooner Ounalaska,

Sir:—I respectfully submit the following report in relation to the exploration of Selawik Lake, Alaska Territory, by the party under my charge, in obedience to your order of August 22, 1884:—

Early on the morning of the 22d of August, the party consisting of Julius Huebner (Mast. Arms), W. H. Ready (Mach.), two natives, Ounalana and Riley, and myself, left in the steam launch, carrying a canvas canoe and complete camping outfit and provisions for six days.

At 8 A. M. the same day I landed on the sand-pit at the entrance of Selawik Lake and remained until meridian for the purpose of taking observations for latitude and longitude, while the natives were engaged in cutting a supply of wood in anticipation of finding none in the lake. At noon started ahead, following the shore line to the eastward and southward, heading for the successive headlands and well-defined bluffs as they came into view, and carrying along two fathoms of water (sand and mud bottom) until 8 P. M., when I came to anchor in a small cove formed by a projecting sand-spit, where we went into camp.

That night observations were obtained for latitude and longitude, and again next morning; we broke camp and followed the shore along as on the preceding day until noon, when we reached the eastern shore of Selawik Lake, where observations for latitude were obtained. At this point a high hill afforded a clear view over the entire basin in which Selawik Lake is situated.

The shores of this lake are high, yellow clay and sand-bluffs, having a height varying from seventy-five to one hundred feet, backed by a rolling, boggy ground extending into the interior and rising often to high detached mountain peaks, interspersed with deep gulches and ravines through which streams of water are discharged into the lake during the spring of the year. At this time they were mostly all in a stagnant condition.

The bluffs are just like those which form the southern and western shores of Hotham Inlet, and are continued all along the south shores of Selawik Lake, extending to the eastward beyond, thence in a general direction to northward and eastward and making a gradual sweep to the north, and finally west to the valley of the Putnam River, forming one large basin. Within this basin I was enabled to trace two rivers and three lakes, viz.: Selawik River and a small river, a small lake and a large lake called the Inland Lake. The last two lakes are connected with Selawik Lake by the two rivers flowing through a low, marshy strip of country covered with a thick growth of brushwood in many places and tall coarse grass.

There are many lagoons communicating with the rivers through narrow channel ways.

After obtaining a latitude position I began searching along the east shore of Selawik Lake for the mouth of the river nearest to us, but soon found it impossible to approach within three-quarters of a mile of the shore on account of a low mud flat making out therefrom.

After proceeding N. by W. for five miles the launch was anchored, and with the two natives in the canoe, I endeavored to reach the shore, which was finally accomplished after considerable wading through the mud and carrying the canoe on our shoulders. Having reached the shore and proceeded but a short distance, the stream of water first seen during the forenoon was found, and, by sounding, a channel about thirty yards wide and ten feet deep was discovered and extending west (true) into Selawik Lake. Through this channel the launch was brought at midnight and camp made on the right bank of the river near an uninhabited native village.

The next morning I started up this river and reached the inland lake, passing, in the meantime, through a smaller lake, the expansion of the river. The river has its source in Inland Lake and flows W. by S. in a very winding course for two miles, when it expands into the abovementioned small lake four miles long and two wide, contracting afterwards to its regular width of seventy-five yards. It runs its winding course three miles more and discharges into Selawik Lake by two mouths about a mile apart. The depth, of eight feet to five fathoms; the banks are covered with grass to the water's edge; also, there is a good deal of brushwood on them. Huts are scattered about and a number of graves were noticed, most of them about two years old. Only one family was found living on the river, consisting of a young native twenty-five years old, his wife twenty years old, and a small boy of three. They seemed hardy, active and intelligent, and in habits and appearance like those of the Putnam. Their hut was mound-shaped, made of brushwood covered with grass and mud, with an entrance through a small hole next to the ground. The height of the house was five feet in the center and the diameter about six feet. Scattered about were a few spears for catching fish and birds. At the time of our visit they were catching small whitefish in a trap made of brush placed across a narrow channel, connecting with one of the many lagoons, and having above it a funnel made of slats allowing the fish to pass through but one way. The river abounds in these fish. We were compelled to boil them, as the natives objected to frying or broiling because to do so would make the fish leave the river and never return. Many Selawik Indians live on this river and all come here to fish in September, when the river is full of fish and at this time they lay in their winter supply.

An examination of Inland Lake showed the water to be shoal; an attempt to find a channel leading to Selawik River was unsuccessful. A narrow channel five miles long in a northwesterly direction was found, but it shoaled to a foot in depth not far from the outlet of Selawik River.

The depth of water in the lake was five feet at low tide, and outside the channel there was no water deep enough for the launch. The lake is of considerable extent. The tide ebbs and flows to and from Selawik Lake. Two days' observations showed a rise and fall of two feet; strength of the flood, one and five-tenths knots; of the ebb, two and eight-tenths knots.

Returning, the north shore of Selawik Lake was observed, but nothing important noted except a small river entering it to the eastward of the Putnam River. Many sand-spits make out at various points around the lake for half a mile, forming small shoal coves. Keeping clear of these spits, two fathoms can be carried entirely around the lake.

Brushwood and small quantities of driftwood are all that can be found about Selawik Lake or the lakes and rivers to the eastward. The driftwood is found on the sand-spits and is used by the natives for house-building, being gathered in the spring when the heavy southwest winds and strong tides bring it over from the Putnam River.

During the return we met the Selawik Indians coming home from the rendezvous in Hotham Inlet. There were about a hundred of them, including men, women and children. In every respect they are like the Putnam natives, with whom they are on the best of terms, often intermarrying. They were kind and showed great pleasure at meeting us. Many presents were given them, and we parted leaving them happy and contented. They reported the existence of a small shoal lake to eastward of Inland Lake, in size like the expansion of the small river.

The water in these lakes and rivers is fresh. Leaving Selawik Lake and going to the eastward it becomes discolored, but is still good for use at this time of year.

Observations were taken whenever practicable. The last two days heavy weather prevented observations to correct the north shore line of Selawik Lake.

On the mud flats in the eastern part of Selawik Lake I saw geese, ducks, curlews, snipe and swan, and on the land back of the high bluffs plenty of grouse. Very respectfully,

Your obedient servant,

John L. Purcell, Ensign, U. S. Navy.

Lieut. Geo. M. Stoney, Commanding Expedition.

On August 27th the Ounalaska got under way and was towed down by the steam cutter to Nimyuk sand-spit. Between this spit and the next a bar with six and one-half feet of water intervened—a month previous nine feet had been carried over at high water. The low water was probably due to the high winds. In order to cross, the schooner was lightened by landing a large part of the stores and outfit on a point three miles beyond Nimyuk. The channel, very narrow and only twenty feet wide in places, was staked out and the vessel kedged over. No deeper water could be found anywhere in sounding across the inlet. There were many sand-ridges about the bar but the main channel here, as in all cases in the inlet and entrance to same, was always indicated by a soft mud bottom. It took two days of sixteen hours each to kedge through this winding channel. All the natives were employed, the men laying out the kedge and the women helping at the windlass. Without this assistance I could never have gone through, for three of the crew were sick, one with congestive chills, one with jaundice, and the third with general debility, and Mr. Purcell was laid up with a badly sprained ankle.

Two much praise can not be given these natives for their honesty, generosity, and ready assistance; all the stores were lying unwatched on the beach, and although natives were camped all about them, nothing was touched; not even such articles as tobacco, tea, sugar, etc., could tempt them.

After crossing, stores were restowed on board, and on September 3d we got under way, and anchored off the trading station, at the mouth of the inlet to water the ship, the water in Hotham Inlet being too salt for drinking purposes. We began carrying water in buckets from the lagoons; but the natives dug holes in the beach about twenty feet from the water's edge, which soon filled up with good fresh water, so I used them to finish my supply. People desiring fresh water should dig a hole in the sand beach about six inches deep and after allowing the water to settle, take it for use; as fast as it is bailed out more runs in. It is thought that this good water runs in from the lagoons near by.

The next day we sounded the outer bar and got only seven and three-quarters feet, though three fathoms had been carried up to it. The wind being favorable and the water rising, I determined on trying to get over, engaging the natives to follow in skin boats to assist in hoisting in the steam cutter; so on September 7th all sail was made and the schooner bumped over. Getting outside, we hoisted in the cutter, paid off the natives, and the journey south was begun.

On September 13th I communicated with the natives in St. Lawrence Bay. They remained grateful for their presents and I gave them a few trade articles. Nothing new concerning the U. S. S. Rodgers was gathered. September 16th, made St. Michael's. Discharged interpreter and guide, and left the next day. September 26th, reached Ounalaska. Rated chronometers, caulked schooner above the water, and took in thirty tons' rock ballast, and on October 7th left for San Francisco.

We came near being lost in the tremendous seas in Unalga Pass. The vessel was undoubtedly saved by Captain Hague, of the Alaska Commercial Company's steamer Dora, who kindly came to my assistance. I would advise no sailing vessels to use this pass. The heavy seas and strong currents render them helpless.

The weather on the passage down was unusually severe, and we were obliged to lie to four times, once for forty-eight hours. Most of the trip was made under single reefed foresail running before the wind. We arrived at San Francisco October 26th, and the following month the Ounalaska was put out of commission.

II.

The results of the preceding expedition were embodied in a report, accompanied by a chart, to the Honorable Secretary of the Navy. The mode of surveying adopted was as follows: Single altitudes and equal altitudes lor longitudes, and meridian altitudes for latitudes, using sextant, artificial horizon and chronometer. The variation was obtained by using time azimuths with the standard compass set up on shore. The method of course and distance was used in measuring between observation points. The width of the river was ascertained by firing a rifle from the water's edge on the one bank so as to hit the bank opposite at the water-line when the range in yards was read from the sight bar. The drift of the current was found by heaving the log.

The work done was from force of circumstances only approximately correct, and when submitting it I requested to be sent back to accurately triangulate and survey the rivers and country, and explore as much as possible the interior of Arctic Alaska. In obedience to verbal orders I submitted plans for a sixty-foot flat-bottomed steamboat, and also in general terms what I proposed doing, the nature of the work and its requirements. In accordance with my request the order was issued giving me the boat, also the steam cutter Helena, used before. In addition I was furnished a small portable steam sawmill to be worked by connecting it with the boilers of either boat, and $2,000 with which to purchase trade articles to exchange for winter clothing, dogs and sleds, and to hire natives. Provisions for twenty months were supplied, most of which were stores left over from the Greely Relief expedition.

All the details were completed by April 26th. The question of getting north then arose. The Secretary of the Navy desired that a vessel should remain in the north with me, and with that view I was sent to Puget Sound to inspect two Government schooners lying there. Neither was large enough, so I was authorized to charter one in San Francisco to take the expedition to Hotham Inlet and leave it there. The two-masted schooner Viking, three hundred and ninety tons, M. Denevig, Master, was the one selected.

The expedition consisted of myself, in command, and the following officers: J. L. Purcell, Ensign; M. L. Reed, Ensign; W. L. Howard, Ensign; A. V. Zane, Passed Assistant Engineer; F. S. Nash, Passed Assistant Surgeon; and twelve men. The large stern-wheel steamboat, named the Explorer, was put in commission April 26th, and hoisted on board the Viking by the Mare Island Navy Yard sheers, with the steam cutter Helena; and stores and outfit were all stowed. Everything was ready when the following telegraphic orders were received:

NAVY DEPARTMENT, Washington, May 1, 1885.

LIEUTENANT GEO. M. STONEY, San Francisco, Cal.

You are expected to proceed under your general instructions to explore the Putnam River and vicinity.

W. C. WHITNEY, Secretary.

Two days later the expedition sailed from San Francisco, and on June 6th anchored in Ounalaska, where we rated the chronometers, leaving June 9th, and on June 27th arrived at St. Michael's.

Here I shipped, as ordinary seamen, the interpreter Aloka and "Riley" (Ounalook), whom I had employed on my previous expedition, and "Bill" (Oukutkoon). The families of these two last were taken along to keep their husbands contented, and to sew, wash, dry fish and assist in various ways. Each family had one child. "Bill's" wife was Annutkan, and his child, Alluke; they were known to us as "Mrs. Bill" and "little Sophie." "Riley's" wife, Shopshuuck, and his child, Toggarack, were called "Mrs. Riley" and "little Riley." Riley and Bill were paid the equivalent of $15 per month in trade articles that in reality cost the Government but $4. The wives and children were fed and occasionally given small presents.

Mr. Lorentz, the agent of the Alaska Commercial Company, kindly furnished me with double reindeerskin winter coats (parkies), for each man of the expedition, two large skin boats (bijdera), and many smaller articles of especial benefit, such as steel runners and bolts, etc.

June 30th we left St. Michael's, the natives being greatly concerned lest they should never get back, and on July 5th anchored off Cape Niniagmo, St. Lawrence Bay. We found the inner bay frozen solid and the outer bay full of heavy drift ice. The natives, our helpful friends in the day of the Rodgers, came on board and were given a good meal of biscuit and molasses. They thought I had more presents for them, and though disappointed were none the less kind. I traded with them for one hundred skin boots and some deer and sealskins. The drifting ice was too heavy to remain long at anchor, so we stood through Bering Strait. July 7th Ensign Purcell was invalided home, taking passage in the whaling ship Ohio, Captain Ellis, bound for San Francisco.

July 9th we anchored off Hotham Inlet, having made in four days the same distance that, on account of ice, had required two weeks on the first expedition. I hoisted out the steam cutter, and having sounded out the channel over the bar, passed in the next day and anchored off the native trading settlement.

On the 11th, while beating up the inlet, the schooner went aground. I lightened her by hoisting out the steamboat Explorer. This was a serious undertaking, as the boat, weighing twenty tons, occupied most of the schooner's deck. I put two chain straps around her forward and aft, hooked in two mast-head tackles, came up the starboard rigging of the schooner, and set the tackles well taut. I then put four jack-screws under the boat and jacked her up, keeping a good strain on the mast-head tackles at the same time, until she was high enough to clear the schooner's rail. Then I put two spars well slushed, across the rails so that twenty feet of end projected over to starboard, and rested the boat on them, shoving her well over. Topping lifts were then gotten from the mast-heads to the inboard ends of the spars, and thwartship tackles were put on the boat; the topping lifts and thwartship tackles were manned and then launched broadside on. As soon as she was in the water, I began preparing her for immediate use.

On the 13th we kedged the schooner off, and took her to within ten yards of the beach—a sand-spit called Pipe-spit. There we made our first camp and called it Camp Purcell; and having built a pontoon bridge from the schooner to the shore, began discharging. Perishable stores were stowed in a house made of old canvas, and a log house was built out of driftwood, in which to cache provisions. July 17th, I left for Putnam River, with Ensign Howard, Passed Asst. Engineer Zane and six men, in the Explorer and Helena, towing three skin boats loaded with provisions. Ensign Reed, as next in rank, was left in charge of the remaining men at Camp Purcell to proceed with the discharging.

Proceeding up the river, on July 19th, I established Camp Depot, on the right bank, about ninety miles from the mouth, where I discharged boats and set up the sawmill, using the

Helena's boiler to supply steam. It worked perfectly. Leaving the Helena and stores in charge of Ensign Howard, I returned to Pipe-spit. July 22nd the schooner Viking left, the Captain having received a written acknowledgment that she had fulfilled the terms of the charter. On the 26th I left Pipe-spit again for Camp Depot with the remainder of the stores, Ensign Reed, and the rest of the party. A reserve supply of provisions, for use in case of accident, had been cached in the wooden hut at Pipe-spit, and a native was hired to watch them.

Passing Camp Depot, where Mr. Reed was dropped and Howard and Zane taken up, I pushed on up, and on July 30th established Camp Gloomy on a high bank of the river, about one hundred miles further above. I chose a bluff, because the river was rising. Having landed the provisions, I left Mr. Howard in charge, and went back to Camp Depot, to pick up Mr. Reed and party and the remainder of the provisions, returning on the 8th with all hands and the provisions. Leaving Ensign Reed in charge, I again started further up the river with a party and half the stores.

On August 11th I found a favorable place, very central, for establishing winter permanent headquarters, from which to send out sledging expeditions. It was a dry, elevated spot on the right bank of the river, at the outlet of a small deep creek, about three hundred miles from the mouth. The place was well wooded, and the creek afforded good winter harbor for the two boats. I called this camp Fort Cosmos, after a club in San Francisco, of which the officers were members. Having discharged the boats, we built a log house for perishable stores, established an observation station, set up the saw-mill, using the Helena's boiler for steam, and began sawing lumber. I then left Mr. Howard in charge and returned to Camp Gloomy for Mr. Reed and party, and the remainder of the stores, and on the 17th all hands and the stores were landed at Fort Cosmos.* The party was then divided into gangs—of fishermen, wood cutters, carpenters, and sawmillers—and the work of preparing for the winter was at once begun. Getting this well under way by August 20th, I left in Explorer for Pipe-spit, to purchase seal-oil, for the dogs, seal-

* The boats not being large enough to carry all my party and stores at once, and not wishing to have them separated by too great a distance, I made the advance up by stages as described.

rope, and other articles that might prove of use during the winter, and also to get some necessary stuff left in the cache. I reached the depot August 22nd, and having made the purchases,got some more dogs, overhauled and restowed the cache, placing the spare chain of the Explorer across the top and piling the extra coal around, I left it in charge of a native watchman and returned to Fort Cosmos, arriving August 30th.

The question of the moment was how to feed the thirty-six dogs we had with us. Paymaster General Smith had failed to provide the pemmican ordered by the Secretary of the Navy, and at least thirty-five hundred salmon would be required for them and the natives during the winter. Hauling the seine did not supply enough; so as the season was advancing and the fish going higher up the river, I decided upon going with a party up stream to catch and buy a sufficient supply—first cutting the seine in half as it was too long, and placing all the sinkers in the half used to weigh it down. The trip was not very successful; the fish were being caught in great numbers by the natives, but they would sell only a few, and on returning I determined on sending another party out later. On September 9th I sent Ensign Howard, Passed Asst. Eng. Zane, one man and some natives, to catch and buy fish and to explore the adjacent mountains. The native women were sent along to dry the fish. The party carried fifteen days' provisions and tracked up the river with dogs in one of the skin boats, returning on the 23rd, having secured two thousand fish and explored the mountains.

By September 11th, all the leaves of the trees had fallen. Only a few whortle and salmon-berries remained. On the 13th, thin ice formed on still water, and on September 21st we saw the last of the geese and ducks; only a few chipper-birds remained. Running creeks froze. Winter had set in and the weather became too cold for outdoor work.

September 24th, drift ice came down the river. The natives began building their winter house. The next day I took the Explorer and Helena up the creek, breaking the ice to make a passage, and laid them up for the winter. The boiler and engine were taken out of the Helena, and by means of shears she was then hauled up on the bank and turned bottom up. The Explorer was left in the creek, and the ice which formed about her was broken up every morning and evening until November 22nd, when she was allowed to freeze in solid to the ground, when all the ice was cut clear of her side, leaving her bottom resting on the ice. Then at a distance of four feet from her, a two-foot ditch was cut in the ice all around the boat extending to the bottom of the creek, so as to provide for any cracks that would otherwise have a tendency to strain her, and also to allow the water to flow by without filling the basin that had been cut for her. September 26th, all hands moved into the winter house. I posted the winter regulations and commenced fire-drill and drill to resist attack.

III.—Fort Cosmos.

The first consideration was the house. Owing to the difficulty of keeping a house warm in the winter, I decided to build partly below ground, though advised not to do so by the traders at St. Michael's, on account of dampness. I believed this could be avoided by building in light, sandy soil. The site chosen was a high, sandy spot, sixteen feet above the river bank, and from plans that I had prepared on the way up, work was at once begun. An excavation 39x42 feet by 3 feet deep was made, and heavy posts thirteen inches in diameter and eleven feet to sixteen feet long were sunk four feet into the ground at the corners and at equal intervals between them, having their sides and inboard faces slabbed off. Grooves one and one-half inches deep, by two inches wide were sunk in the sides. Logs slabbed on three sides, with tongues cut at their ends, were fitted into the grooves of the posts, with the rough sides outward, and chinked with reindeer moss. The lowest of these logs, the sleepers, were as thick as the posts; the others were smaller. The frame of the house was proportioned so as to have a height of six feet along the walls on the inside and give to the roof a pitch of five feet.

The roof was of plank, over which was put eight inches of grass, and then six inches of dirt. The excavated dirt was banked up on the outside of the walls as far as the eaves. Openings were cut for window and a door, and double windows and a heavy door were put in. On the inside, posts were set in the ground with mortises cut in them for receiving the sleepers and beams. The house was partitioned off, and all living quarters lined with painted canvas.* The sides of the bunks were lined

* I would specially recommend tarred building paper for the roof. When the snow melts in spring the paper would prevent leakage.

with straw between canvas and logs, and the bottoms were covered with one and one-half inch plank on six inches of straw. In the galley and drying-rooms the floor was of faced saplings. Bearskins were put on the floors of both officers' and men's quarters.

A butt containing one hundred and four gallons of water was mounted high up in one corner of the drying-room, connecting by pipes with the water-back arrangement in the galley, which kept the water warm. A small rubber hose was attached to the butt, that could be led to any part of the house to extinguish fires, and fire-buckets filled and ready for use were kept around the butt. There were twenty-eight inch cast-iron box-stoves set in boxes of sand in the officers' and men's quarters; their pipes and the galley pipe all led to the chimney, for which the smoke-stack of Explorer had been utilized, in the drying room, where the washed clothes were hung to dry. Coolers of drinking water were in the officers' and men's compartments. Over the galley, a 27x24 Westwood range, there was a large tin hood connecting with a pipe made of empty milk-tins which led into the smoke-pipe and carried off most of the galley odors. There was also a tin cover to the water-butt to keep out dust and hold the heat. The water-back arrangement was a success. I consider it an excellent one for use in an Arctic ship. It required no extra fuel, and kept the water in the butt at about 100° F., never less than 90°, and often 120°. If used on board ship, I think all the water needed could be had by melting snow. The traders when told of the contrivance immediately took steps to procure one.

Six months' provisions were placed in the store room, and the remainder in a hut outside, visible from the windows. There were two standing lights in the drying-room over the carpenter's bench, and the machinist's bench. In the quarters hanging lights were used.

The house as above described and arranged made a comfortable home. There never was any dampness until late in the spring when the constant rains made the roof leak a little. A careful record of the wet and dry-bulb thermometer never showed a difference less than 10°. Indeed, so dry was the air that evaporating pans of water had to be used on the heating stoves. Nor was there any difficulty in keeping the house warm. The authorized temperature was 65° and it was seldom lower, but often higher, when the front door was opened to keep it right. No ceiling was put in the house as at first intended, because it would have made the quarters too warm.

After taps at 10 P. M., the front door was opened for fifteen or twenty minutes to cool the house for sleeping, and all fires hauled except a light one in the men's quarters for the comfort of the man on watch. In the morning, when all hands were exercising, all the doors were opened and large fires made in the stoves.

The Routine.

Daily winter routine was from November 1 to March 1.

8.00 A. M.	Call all hands.
8.30 "	Breakfast. Soon after men make up their bunks.
9.30 "	Turn to. Fill butt. Measure ice and rise and fall of river. Make up officers' bunks. Clear house of people. Open all doors. Keep heavy fires. Executive officer inspect quarters.
11.30 "	Serve out lime juice, an officer to be present, who then also inspects the dinner.
Noon.	Dinner.
1.00 P. M.	Turn to. Get wood for stoves.
4.00 "	Fill butt. Knock off work.
4.30 "	Studies—officers instruct men as they desire.
6.00 "	Supper.
6.30 "	Turn to.
8.00 "	Haul galley fires and report.
10.00 "	Taps. Out lights. Haul stove fires. Inspection by officer. Report all secure for the night.
	Men not allowed in bunks between 8.00 A. M. and noon, and 1.00 P. M. and 4.00 P. M.

Weekly Routine.

Sunday.	9.30 commanding officer inspect men, rifles and quarters.
Monday.	Officers wash clothes.
Friday.	Men wash clothes. Fire quarters.
Saturday.	Thoroughly clean quarters. Issue weekly rations.

Every other week, air bedding.

Monthly Routine.

First Sunday.	Read articles for better government of the navy.
On the 1st day.	Medical examination of the party.
On the 12th day.	Weigh party.
Once a month.	General alarm; prepare for an attack.

The man on watch relieved every two hours.

SITE OF FORT [illegible]

Spring Routine, March 1.

7.00 A. M.	Call all hands.
7.30 "	Breakfast. Make up bunks.
8.00 "	Turn to.
Noon.	Dinner.
1.00 P. M.	Turn to.
5.30 "	Knock off work.
6.00 "	Supper.
6.30 "	Turn to.
10.00 "	Taps.

Special attention was given the bills of fare. Officers and men lived alike. The cook was a good one and the food plenty and excellent. We had fresh meat twice a week during the winter, and every day in the spring. This consisted of deer, ptarmigan, rabbits, and fish. Most of the deer-meat came from the Notoark valley—twenty-five hundred pounds of it were consumed. There were also eaten eighty ptarmigan and twenty-five rabbits, sixty-seven geese, seventy-six ducks and two sand-hill cranes. The geese, cleaned, weighed from four to six pounds; the ducks, one and a half pounds. Most of the fish were caught just as the river was freezing; as soon as taken out of the water they froze and remained so until used; only a few were caught in traps during the winter. A fish called the "See" by the natives was most appreciated, and the "Coup-tick" came next.

At all meals tea, coffee, milk, sugar, molasses, pickles and condiments were issued to the extent desired. As great a variety as possible was observed in the bills of fare, though about certain eatables a regular daily routine was thought best; thus, every breakfast there were cakes, and butter was used at this meal only. Soft bread—generally rolls or biscuits—was given every night for tea.

It should be remarked that pork and beans held the leading place in the list of relished food; next in order came Philadelphia pepper-pot soup, and among desserts plum-duff with hard sauce surpassed all competition. For drinking, coffee led for the first half the winter. Tea came gradually into favor, however, and by spring it was preferred by all hands. I would advise that some spirits be always carried on similar expeditions; a little given occasionally is undoubtedly beneficial, stimulating the mind as well as the body. I had none with me; but the little alcohol given with the lime-juice did much good.

A good cook is indispensable in keeping up health and spirits and both these are of primary importance on such expeditions. There was never any grumbling about meals, and at the sight and odor of the really excellent food any discontentment of the moment disappeared.

Health and Exercise.—Not one case of sickness occurred. The entire party when in quarters took exercise daily between 9.30 and 11.30 A. M. The officers generally walked, the men cut wood and worked about the fort; the machinist overhauled the engines and the carpenter built sledges, etc. A monthly examination of the party was made by the surgeon and the results reported. Also every month the members of the expedition were weighed. No appreciable change was observed during our entire stay. At first, when the carpenter and machinist were kept at work inside the house it was noticed that they became very pale. Making them leave their benches and go out doors remedied this. The rigid enforcement of these health-rules created the only murmuring during the whole trip.

Amusement.—The spirits of the men were always good and cheerful. Knowing music to be of great assistance, I took with me a tournaphone which proved a source of great pleasure to everybody. To have some musicians among the men of an Arctic party is of importance. It would be well, too, to take a few bright, cheap chromos and some colored globes for the lights to enliven the walls of the quarters. Pictorial papers are a never-ending source of pleasure, no matter how old they may be. My men never tired of looking at them, and a few of the most striking they put up on the walls. Light, sensational novels were relished, also simple histories, stories of travel, geographies and rudimentary works of science. Games of cards, dominoes, checkers, etc., were played often by all hands, and thoroughly enjoyed. Skates made by the machinist afforded a great source of amusement. Expeditions should carry skates, as those made on the ground are not very good.

Society.—The men got on admirably together; there were no fights and no serious quarrels or disagreements. The little annoyances incident to such close companionship were philosophically borne and readily forgiven and forgotten.

Instruction.—Every day an officer instructed the men in whatever branch might be desired. Mathematics was the favorite

LIEUTENANT STONEY IN ARCTIC COSTUME.

study. Nearly all the men took lessons during the beginning of the winter; but the number gradually lessened; only three holding out till spring. An attempt was made to teach Aloka, the interpreter, how to read, but he took so little interest in the work, it was given up.

Punishments.—These consisted in extra watches given to men who had been careless in recording observations, etc. An occasional loud oath or word called for a reprimand. But such misdemeanors, I am glad to say, were surprisingly few.

Clothing.—Beyond question fur clothing is the only kind suitable for Arctic wear, and it should conform in material and cut to that worn by the natives. The members of the expedition wore deerskin coats with hoods (parkies), deerskin trousers, deerskin boots and deerskin socks, over underclothing of flannel. The parkies are shaped like a shirt with a hole in the neck just large enough to admit the head; around the back of the hole the hood is sewed. They are double, the inner skin being light with the fur turned towards the body, while the outer skin is of the heaviest with the hair turned out. The trousers, of heavy deerskin, the hair turned out, were of two styles—like sailors' trousers and like citizens' trousers. In the former style, they were buttoned around the waist, in the latter they were gathered around the waist by a string. I preferred the flap, finding it more convenient; most of the party, however, liked the other. The bottoms of the trousers must always be tucked into the boots. The boots are of deerskin with soles of the same. They should be made with the skin of the deer legs, the toughest part of the hide. The best trousers are also made of this part. The legs of the boots have the hair turned out, while the soles have it turned in. The socks are made of skin with very thick hair, turned in. The party wore woolen socks next the feet, and over these the deerskin socks. A belt should be worn outside of all to tie down the parkie and keep the wind from getting under. An overall of some light material, drilling or calico, same shape and length as the parkie, should always be worn when out on a trip, especially during a snow-storm or drift, to keep the snow out of the hair; for once in, it melts when the parkie is worn in the house, and the garment is ruined. The same rule applies when the deerskin trousers are worn.

While sledging much comfort will be found in putting across the length of the nose a piece of deerskin with the hair turned in. This piece should run far enough back to cover the cheeks, and fasten at the back of the head. Similar pieces should be put across the forehead and chin. The beard on one's face, especially about the mouth, should be worn short on account of the condensation and freezing of the moisture of the breath; but that on the chin and neck should be long, as it is a splendid protection. A skull-cap, fitting close, and coming down over the ears should be used, for only in extreme weather is the hood comfortable. The Elsinore cap of the whalers is as good as the skull-cap and should take its place where it can be had.

Mittens of deerskin, the hair turned in, are the only things that will keep the hands warm. Woolen mits with one finger on them may be worn under the deer-mits, especially when out hunting; but for warmth the deerskin alone is better. The woolen mits stop ventilation when inside the deer-mits and get moist from perspiration which freezes when exposed; in deer-mittens the hair takes this up and the congelation occurs away from the hand. When the deer-mit gets cold it can be turned inside out, and by striking, the ice is knocked off.

The underclothing we used was of thick substantial flannel. Chamois underclothing is the best. I had had them on my first trip. Use large horn buttons on clothes, as small ones are difficult to manage when the weather is very cold.

For summer wear overalls are good. Boots should be of sealskin tanned with the hair off. Straw should be worn inside the boots to protect the feet when walking on stones and rough places. Sealskin boots are water-tight and the only foot-gear suitable for walking on tundra. Other boots lamed all who wore them longer than a day. In the spring, when it is too cold for woolen clothing, outer garments of sealskin are excellent. The skin should be tanned with the hair on and should be worn with the hair out. Melting snow ruins deerskin clothing; besides, in the spring they are too warm. Soles of boots made of deerskin, with the hair inside are excellent for winter use, especially where there is a great deal of walking. Snow-shoes are indispensable; large ones for country use, small ones on the seaboard.

IV.—Summary of Events and Work Done from Going into Winter Quarters until Our Departure.

As soon as we were well settled in our winter quarters, preparations were begun for carrying out the main object of the expedition; that is, the exploration of the Putnam River valley, and the regions adjacent.

The selection of Fort Cosmos as a base for this work proved to be a most happy one. Lying as it did well up to the head of the river, we were able to strike across the several divides into the adjoining river-valleys by comparatively short routes, making the total number of miles traveled by the several expeditions sent out, less than would have been necessary from any other point.

On October 1st, the river became clogged with ice; by the 13th, it was frozen solid for the winter. November 1, the ice was sixteen inches thick, the weather very cold, and we began taking daily exercise and the use of lime-juice. On the 24th, I thought I felt a slight earthquake shock; the other officers noticing it also. It may have been caused by the ground cracking from cold.

December 1st, I left with a party to explore the head waters of the Notoark, the Inland River of Captain Beechey, and the country to the northward, returning on the 18th. Ensign Reed was left in command at Fort Cosmos, with written orders. December 6th, Dr. Nash and party left for the inland trading post of the Yukons to obtain ethnological information. They returned on the 12th, accompanied by some Yukon natives. December 26th, Passed Asst. Engineer Zane and party left for St. Michael's, returning on February 25th, 1886. December 29th, I left with party to explore Selawik Lake and River, returning January 7th, 1886, Ensign Reed being left in command.

On January 20th, I began a series of observations for establishing a base line for the purpose of triangulating the Putnam River valley. February 28th, I left on a trip to explore the head waters of the Putnam, and the country to the northward, from which I returned on April 6th, Ensign Reed being left in command. March 1st, spring routine went into effect. March 10th, Ensign Reed and party left for the "hot spring," leaving Ensign Howard in charge at the Fort, and returning April 2nd.* April

* Detailed accounts of the several exploring expeditions are given in Chapters VI and X.

12th, Ensign Howard and party left for Issheyuk, where in accordance with arrangements made on my visit in March, he was to join the natives and accompany them to Point Barrow, whence he was to return by sea and meet us at Hotham Inlet.

April 26th, geese were seen flying over and snow-buntings appeared. April 30th, signs of life began to be visible in trees and bushes, and natives began moving from winter-quarters to high land. Discontinued the use of lime-juice. May 3d, floated the Explorer. May 19th, the ice cracked along the banks of the river and began drifting. The main ice in mid-river held a few days longer when great masses broke off and drifted down. May 27th, launched the Helena, put in the boiler and engine and got both boats ready for use. The ice began breaking rapidly. The water in the river would rise a couple of inches in one hour and fall suddenly the next, indicating the forming and breaking of large ice-gorges. May 30th, the whole body of ice started and then jammed, raising the water five inches in fifteen minutes. Then the mass moved lower down. I got steam up in Helena and towed the Explorer three miles up the creek, to be clear of all danger and left a crew in her. Mosquitoes appeared and the grass began to show green.

By June 3d, the river being practically clear of ice, I towed the Explorer down to the Fort, got her ready, and began preparations for leaving. On June 8th, I started down the river with half the party in the Explorer, towing two skin boats, with provisions and leaving Ensign Reed in charge of fort, with orders to continue the preparations for leaving. I returned on June 13th, having established Camp Retreat in the delta, about thirty miles from Pipe-spit. The next day Passed Asst. Engineer Zane, with a party, and the remainder of the stores left in the Helena for Camp Retreat.

June 15th, I moved on board the Explorer, closed the house where the expedition had been quartered for two hundred and sixty-two days, and abandoned Fort Cosmos. I left a record sealed up in a pickle-bottle and buried at the observation spot. It contained the names of the party, and stated that the expedition had lived there from September 25th, 1885 to June 15th, 1886, and that the health of all had been good; that there had been no trouble with the natives, and that on June 15th all hands had started for Hotham Inlet.

On June 17th, having started the party off, I went up to the head of the valley and began in the work of triangulating down the river. I reached Camp Retreat June 25th, having brought the work down to the mouth of the main stream. The next ten days were spent on the work in the delta, when I returned to camp, July 5th. On July 7th all hands left Camp Retreat, and that night pitched tents, unloaded boats, and established ourselves for the time at Camp Purcell, on Pipe-spit. The next day I returned to Camp Retreat and brought the remaining stores down to Camp Purcell.

July 12th, Ensign Reed and party were sent to complete the work in the Notoark River. They were towed about sixty miles up the stream and left to carry explorations up to the point where I had left off in December. They returned on the 22nd. July 16th, I left in Explorer to further explore and survey Selawik Lake and River, Passed Asst. Engineer Zane being left in command at Camp Purcell. We returned on the 24th, having completed the work. On July 20th, Lieut. Hamlet, U. S. R. M., executive officer of the U. S. Revenue Cutter Bear, which had arrived off Cape Blossom, visited Camp Purcell, bringing mail and communications. Passed Asst. Engineer Zane, representing the commanding officer, paid an official visit to the Bear, July 22nd. July 27th, I left with party in Explorer to visit the mountains north of the Putnam River in search of jade-stones, returning on August 7th, having found the jade-stones.

V.—Travel and Transportation—The Best Routes.

Experience has proven conclusively to me that in Arctic Alaska the surest and best routes for travel lay along the rivers and lakes. Going across the country is seldom practicable. In summer walking over the tundra land is so fatiguing that but little headway can be made. While in winter the snow lies to a depth of from ten to fifteen feet, in many places drifting to a much greater depth. A road has to be broken ahead of the sledges by men on snow-shoes, and the snow is so dry that the least motion in the air will cause it to move and cover your tracks before you can retrace them. Then, too, you encounter brush through which a way is hard to make. Along the rivers and lakes you have the banks to guide you, and where the snow has been blown off, which is often the case, you have a smooth surface to sledge over. In places where the current is strong, however, the ice overrides and makes it very rough, and a road has to be cut through or you must go around. Such places do not occur often.

Dogs.

The dogs of Norton Sound and the Yukon River are superior to all other Arctic country dogs I have seen. Undoubtedly this is because the traders have improved the race by crossing strains and introducing new breeds. Dogs are numerous and easily obtained in summer when only a few are used for tracking. They cost from $3 to $5 apiece in trade articles whose absolute value is only $2 or $3.* In winter dogs are not often for sale, and if purchased, bring exorbitant prices. In choosing a dog, first look at his teeth. These should be well formed, glossy white, and all in place. In old dogs the teeth are discolored and the molars are worn, preventing them from chewing bones and frozen meat, often their only sustenance on long journeys. One of my dogs died of starvation on this account. Between three and six years of age the dog is in his prime. Before this he is rather delicate for hard work; and after his sixth year he begins to fail. In addition to perfect teeth a good draft dog should have a short neck, thick shoulders, broad back, solid legs and large paws, with little hair on them, especially between the toes, since the ice clogs them and causes sore feet; for the same reason the legs should have short hair. He should have a good thick growth of hair on the body to keep out the cold.

Never get sluts for sledging, as they are too tender. There have always been disagreements as to the advantages derived from emasculation. The Touches in Siberia always do, while the Inuits never. Half of my dogs were, and I unhesitatingly pronounce in its favor. The Inuits object to it; it stops breeding and they claim that it also affects their power of endurance. This latter I did not find true; my gelded dogs proved as good, as hardy, as intelligent and less belligerent than the others. And to stop their fighting is a matter of importance for it seemed to me they were always quarreling, except when constantly watched and worked, when some unfortunate is rendered useless for

* These were the prices paid on my visit. I understand they are much greater now.

several days. To prevent this they were all kept chained separately. Another advantage of chaining is that the food can be fairly distributed. These dogs are tractable and intelligent. They obey tolerably well through fear and not affection—for there is no affection in any Esquimaux dog's nature. They recognize those who feed and take care of them, and stay where they belong. In selecting dogs get those of moderate weight, seventy-five pounds. Heavy dogs require more feeding, are no better pullers, ,and are clumsier and lazier; then, too, they break through snow-crust where a smaller can safely go.

Most of my dogs came from Norton Sound. They did not stand the sea-trip well, getting very seasick and vomiting the little food they ate, and they got badly constipated. Their main sustenance was water, and they drank it all the time. Fish was my principal dog-food. It should not be given raw and fresh, for though hunger may drive the dogs to eat it, it makes them vomit. Fresh fish should be roasted or boiled. Boiled food fattens rapidly but makes them soft. A little oil given twice a week is beneficial; it keeps the bowels open; given too often it makes them short-winded and thirsty. Dried fish is the best food; the objection to it is its bulk. This I remedied by cutting up the fish, mixing with oil, and putting it under a pressure of three hundred pounds. The surplus oil was squeezed out and the fish pressed into compact cakes. I would recommend that a cooked meal with oil be occasionally given, especially after several days of hard travel. Such a meal seemed of more service than a day of rest. Cooked deer-meat is passably good, though its effects are often unaccountable, sometimes inducing diarrhœa, and sometimes such painful constipation that the dogs howl. The best of all food if procurable, is pemmican; even with this, a warm meal will be beneficial after heavy work.

They should be fed once a day, an hour after stopping for the night. Give them as much as they wish or as much as the supply will permit. They go to sleep immediately after, and in the morning are in prime condition. Feed only at night, never during the day while traveling, for it makes them lazy. A dog is good for six days' work; then he should be given one day of rest and if possible, give a meal of cooked food. Some claim that a dog is good for ten days, but in this case he must be given more than one day to recuperate. It may be difficult at times to get wood to cook food, but the benefit the dogs receive from a hot meal warrants the trouble. Dogs are tender the first forty-eight hours of a journey; their bowels get loose which makes them weak; they should be worked slowly on first start. The natives claim their dogs sometimes went mad; but in my entire stay I never had a rabid dog. One of my dogs showed sign of rabies, so the natives said, but a pint of seal-oil restored him. This madness is caused principally from constipation. The fact is that even with the native dogs, who get no care, you never hear of a case in summer when animals get grass and more digestible food, and plenty of water. The symptoms of the madness are marked. The dog becomes droopy, his eyes grow glassy, he froths at the mouth, which is soon followed by fits. At the first symptom give the oil. Strange to say, when a dog goes mad, the others will in a body jump on him and actually tear him to pieces.

For transportation sledges drawn by natives or dogs or by both are the most practicable. Reindeer are not desirable, as they have little strength and endurance as compared with the others. The fact that the Siberian natives, who have herds of tame reindeer, use their dogs for transporting their camp outfits, proves the superiority of the latter.

As between the natives and the dogs, the former are to be preferred, as in addition to their intelligence, they can pull nearly three times as much as the latter, and can exist on as little food. Four natives can pull a sledge-load of over one thousand pounds over a comparatively rough country, while it would require at least ten dogs to do the same work. My dogs were the subject of careful investigation; they were carefully weighed before and after trips, their habits were noted, and I fed them myself. It was observed that in the beginning of a trip, each dog lost a pound a day for the first ten days, after which the weight remained steady. On returning from trips, and giving rest and good food, there was a steady gain of one pound per diem until the normal weight was reached.

Food for the Men.

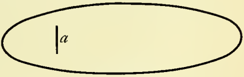
Food of the most condensed and heating character only is recommended for a sledge trip. This should be put up in waterproof packages of a size best adapted for "packing" and stowing on the sledges. Pemmican, I regard as the best food for an

Arctic journey. It is made as follows: The best lean beef without fat or sinew is dried and ground up and then allowed to absorb all the pure beef tallow it will take up. A few currants added make it more palatable. After it, come canned pork and beans, canned soups, jerked beef or venison, sausage (Bologna), pork, lard, canned corned beef, flour, cornmeal, oatmeal, hard-bread, sugar, tea, coffee, chocolate, condensed milk, butter, salt, pepper, rice, pulverized potatoes and onions, dried and canned tomatoes, sauer-kraut, olive-oil, flavoring extracts, plum-pudding, raisins, sauces and lime-juice. The kind and quantity of food taken must of course depend on the length of the journey, and the facilities for transporting it.

Sleeping Bags.

A sleeping bag for each person is almost indispensable on a sledge journey. It should be made of reindeer skin, with the hair side in, and covered with some light water-proof material. The deerskin is far superior to sheepskin, being much warmer and lighter. Had wool been the best, the Creator would have put it on the reindeer. The same applies to clothing.

In making the bag it should be cut so as to have as little bulk as possible. It should be not over six inches longer than the body, and just so much larger as to allow the occupant to turn freely without turning the bag with him. At *a*, near the head in the figure, is a slit large enough for the occupant to get in feet foremost. The head is then drawn in and the slit laced up from the inside. One might think he would suffocate, thus shut in, for want of air. My experience was that I got too much air. I do not recommend double bags. After the hardships of the day, undisturbed rest is desirable, and this cannot be had with two people in one bag, to say nothing of other disagreeable features.



SLEEPING BAG.

VI.—Winter Explorations—Expedition to the Upper Notoark and Headwaters of the Colville River towards Point Barrow.

On December 1st, 1885, I left Fort Cosmos, with Ensign Howard and four natives, to explore the headwaters of the Notoark or Inland River, and to decide on the practicability of sledging to the northward to Point Barrow. My outfit consisted of three sleds, twenty dogs, rations for twenty-five days and a complete traveling equipment.

The route lay across the tundra on the northern side of the Putnam valley, over to and up the Nut-vuck-to-wo-ark River.* This road is good in early winter; later the snow is drifted into the valleys by the high winds to a great depth. A great objection to this route is that the rapids do not freeze; a thin ice forms over them, which is so deceptive that dogs and sleds break through, necessitating the making of roads along the banks among the growth of low brush; and even here are numerous springs so treacherous that I often went through. Sometimes there is no covering to the fast-flowing water and fordings have to be made; the water is shallow enough, but the dogs have to be pulled in, and one's boots of deer-hide must be changed for others of seal. The dogs suffer from the water freezing on them, and changing boots in an atmosphere of 50° F. below zero is not pleasant.

To cross the thin ice over running water, the natives make a bridge by laying saplings, two and three feet apart, over the crust and covering them with brush, which makes a slippery surface for the sleds. A long line is made fast to the end of the drag-rope and the other end is manned by natives on the other side of the bridge, who haul the dogs on to the bridge; once on, they quickly get over to the strong ice. By these bridges I crossed, with a sled weighing several hundred pounds, over ice so thin that it could not bear the weight of a single dog.

Whenever stops for the night were made, the dogs were chained up and the tent pitched when the weather was bad, otherwise a native camp was constructed, as follows: Selecting the most sheltered spot, a pit is made in the snow about fifteen feet square and six inches deep by stamping it down with the feet. Around this is built a wall about four feet high by laying young spruce trees on top of one another, and cutting off their inside branches on the side you sleep. This wall has two openings or breaks at one end opposite each other, dividing the wall and pit

* This river I named the "Ambler," in honor of Passed Assistant Surgeon Jas. M. Ambler, U. S. Navy, Medical Officer of the Jeannette Expedition.

GETTING READY FOR TRIP.

into two parts with a through passage way separating them. Along this way, which must always face the wind, a fire is made of dead wood. On one side of the fire, fine boughs are laid down on the snow and on top of them the sleeping gear. Such night camps are recommended; they are easily made and the coldest nights can be comfortably passed in them. The only drawback is the annoyance of getting wood.

As the return route was to be the same as in going, I cached unnecessary provisions and decided to depend principally on the country; a hole eighteen inches deep was dug in the ground where the fire had thawed it; this was lined with spruce boughs, the provisions put in and covered with more spruce, over this dirt was thrown, then the ashes of the fire, and the whole was covered with snow. The heat melting the snow wets the ashes and dirt and they freeze solid. The reasons for such careful stowage is to keep out the wolves; they dislike ashes and find it hard work to get through them and the frozen ground. The dirt freezes so hard that oftentimes it has to be thawed by building fires on it. The natives when using this route, take only a few provisions; they stop and hunt, and lie over to enjoy the feasts. The food not eaten is cached.

After reaching the headwaters of the Nut-vuck-to-we-ark it was necessary to climb up a smooth snow-hill to reach the divide. Sleds were unloaded and everything carried up. The white men found this very difficult, having to cut footholds in the snow; but the natives scaled the hill with ease. From the top of this divide the view was superb; high mountains, deep gorges, rolling valleys, rivers, cataracts, frozen waterfalls, met the eye continually.

On December 9th, I reached Nimyuk (Cotton-wood), the highest settlement on the Notoark River. The village consisted of four huts and thirty inhabitants, subsisting almost exclusively on deer-meat of which they had at least two thousand pounds on hand. The day of my arrival they killed thirteen deer; and in some of the caches were as many as thirty. I was considerably annoyed by the curiosity of these people and by their superstitions. As it was their dancing season, no meat could be cut with an axe, so I was compelled to saw up a frozen deer—a difficult task. Neither could any meat be cooked in a house nor any tea drawn; it had to be done outside and passed in through the chimney-hole. These fancies are persisted in because they think that to do otherwise would drive the deer from the mountains. In most places these habits could be overcome by paying, but I met with no success at Nimyuk though offering tempting inducements.

From Nimyuk I stood to the northward and eastward, following one of the branches of the Notoark to its source in the mountains, then over the dividing ridge where I struck the headwaters of the Colville River, down which I traveled several miles, coming to Issheyuk, a village of fifteen huts, situated near the northern limit of the mountain range. Approaching the settlement, I was stopped by some natives who demanded tribute; my natives becoming terrified, advised compliance. Suspecting foul play, I told them I would consider their request when the village was reached, and so proceeded on, and soon learned that my supposed ignorance of their ways had induced some scamps to attempt to impose on me. Their failure was laughed at by the body of natives at the village, where several hundred of them were gathered from all parts of the Notoark and surrounding country to have a big dance. This large body of natives surrounded us, the men beating tom-toms and the women singing, and for a time we felt anxious; but, their ceremonies over, they gave the hand of friendship and extended the freedom of their village. I remained one day at Issheyuk and learned that some of the natives went to Point Barrow every summer. This information was verified by the army blankets, army overcoats, and army buttons which they had, and which they said, they got from white men at Point Barrow, evidently the party of Lieut. Ray, U. S. A. I offered every inducement to be taken to Point Barrow, but without success, for they declared that to go at such a time would result in starvation. However, they offered to take me next spring. Not having enough provisions to last until then, I decided to return to Fort Cosmos and to try more to the eastward. Before leaving I made arrangements with the most influential man, Oupuk, to send a party with him to Point Barrow in the spring in case I could find no better route to the eastward. So on December 12th, I left for home, following the same route, and arrived at Fort Cosmos, December 19th.

At Nimyuk, at the headwaters of the Notoark, the natives live in hemispherically shaped huts similar to those of the Putnam; they have two ice windows on either side the entrance and a meat-

NATIVE HUTS, PUTNAM VALLEY.

stand opposite. On this meat-stand at the back of the hut and opposite the entrance, several hundred pounds of deer-meat are always kept, so that a quantity will be on hand sufficiently thawed for use. As soon as I entered, some of this partially thawed meat was handed me on a tray. Meat is never cooked but once a day, in the evening before turning in. About 5 P. M. a large fire is started and the pots full of meat are put on. These pots, the ordinary boiling pots of civilization, they get in trade; in their absence pots made of clay from the Selawik River are used. The cooking is done by the women who taste the meal from the moment it is put on the fire until it is thoroughly cooked; then the fire is dexterously thrown out through the chimney hole in the roof, by young men using long sticks as tongs. When the hut is clear of smoke, the flap that covers the chimney is hauled over for the night, and all hands go to sleep. When the hunters return from a trip they are given a hot meal. Upon entering the hut they take off most of their clothes and their wives and daughters hang them up. Then they fall to, eating pounds of the boiled deer-meat and drinking gallons of the soup; a pipe is next enjoyed, and then all hands turn in for the night. All the household are fond of stripping and baking themselves before the fire, particularly the old people who go so close as to almost blister their skins; they say the heat makes them young and drives away their pains.

Expedition to Selawik River.

On December 29th, 1885, I left Fort Cosmos with three natives, two sleds, sixteen dogs, and provisions and outfit for ten days. My object was to explore the country between the Putnam River and Selawik Lake, and to see if there was a Selawik River. The route followed led across the southern side of the Putnam valley, through a pass over a ridge of hills, 400 feet high, into the Selawik valley. The country was rolling tundra land, generally bare, with a scant growth on the banks of the small streams and around the lakes. Finding a Selawik River, I traced its course for many miles. I cut through the ice and found no appreciable current, but water deep enough to float the Explorer when the river broke. A range of mountains 2000 to 3000 feet high, running in spurs with high hills between, makes the watershed between the Putnam and Selawik Rivers. The natives of the

Selawik are miserably poor and badly clad. They get little meat, as few deer are found in the neighboring mountains; so their main food is fish and the berries they gather in autumn. Their habits and customs are like those of the Putnam natives. The journey was particularly hard because of the cold weather, the thermometer ranging between — 60° and — 70° F.; and also because only a little wood was procurable for making fires. The dogs suffered terribly, their feet cracking open and bleeding with every step. I was compelled to employ natives to drag the sleds where the roads were heavy. I reached Fort Cosmos after an absence of ten days with some of the dogs so far gone they had to be carried. This trip was of much service in that it showed me the nature of the work to be undertaken by the Explorer when the Selawik River opened.

Expedition to the Northeast toward Point Barrow.

On February 28, 1886, I left Fort Cosmos to explore the headwaters of the Putnam and the rivers and country to the northward, and also, if practicable, to reach Point Barrow. I took with me two natives, the interpreter, three sleds, nineteen dogs, and outfit and provisions for twenty days. The route lay up the Putnam. At Kallamute one of my natives refused to go on until the day following, and all the inhabitants of the village sustained him, so I left without him. However, by noon he overtook me, saying his wife insisted on his going.

Before reaching Par Village a messenger from Saulogs, the most influential native of the Putnam, informed me I could travel no further without paying tribute. My answer was that I would make no payment and that I would keep on. As I drew nearer the village his mother came out and ran ahead of my sled, refusing to notice me or answer my questions. A still worse sign of displeasure and anger was that the inhabitants kept in their houses instead of coming out to greet me. Arriving in the village, Saulogs sent for me; I not only refused to go to him myself, but also forbade my interpreter's going. My entire disregard of Saulog's presumption, and the position I took, that I was the greater " Oumalik " or chief, resulted most beneficially, though probably I was more concerned about the outcome of the matter than he was, being the only white man in my party. I carried my point and he sent his wife to hold a council of peace, which terminated amicably and I proceeded as I desired.

The journey up the Putnam was one of unusual hardship. The weather was most of the time wretched, and the roads so bad that a way had to be tramped down so that dogs and sleds could get along. The drifts were extensive, and so deep as to sometimes cover the dogs so that they could not move. Nor was traveling on the ice much better; open water was met often, and sometimes we got in. Occasionally rotten ice was crossed by laying brush on it; once in a while a bridge of logs was necessary, and at length all travel was stopped and I had to wait for the way to freeze hard. This state of affairs lasted all the way up to the headwaters.

After reaching the headwaters of the Putnam I crossed to the northward over a pass of gradual ascent for two miles, then down a half-mile to a branch of the Al-lash-ook River, a tributary of the Koyukuk or Tug-ga-rag-a-wick, rising at the foot of the pass. The pass was covered with a scrub growth of spruce. From the highest elevation (800 feet above the Putnam) I could trace for miles the headwaters of the Ko-Ka-chut-na, another tributary of the Koyukuk or Tug-ga-rag-a-wick River. But a few miles were traveled on the tributary of the Al-lash-ook (a narrow winding stream, wooded like the Putnam, shut in by mountains), when another pass two and a half miles long was crossed on a N.N.E. course. Then our road led, partly over a chain of long narrow lakes, to the Al-lash-ook River.

The same hard traveling was found on the Al-lash-ook increased by worse weather, and one day a regular arctic gale was encountered. The snow was so deep at times that we sank to our waists and had to plow along to get out.

The Al-lash-ook River is a long stream running along the eastern side of the range of mountains that form the head of the valley of the Putnam. It has its origin in the mountains to the northward and discharges into the Koyukuk River to the southward and eastward, and this in turn empties into the Yukon River near Nulato. Only a portion of the Al-lash-ook was explored by me, as indicated by sledging track on chart. The valley of the Al-lash-ook where I met it, is from four to six miles wide, between mountain chains 3000 to 3500 feet high, with the river running through the center, its width varying from fifty to two hundred and fifty yards. It is shallow and filled with boulders about which a strong current runs. The growth and physical features are similar to the Putnam.

There are many lakes in the valley and mountains. Lake Ta-kahoela is the largest visited. It is eight miles long, one to one and a half miles wide and very deep; the main axis runs N.N.W. It is entirely surrounded by mountains excepting a narrow defile through which a winding stream runs to the Al-lash-ook. The water of the lake is clear, the bottom at a depth of five fathoms being plainly seen through the six feet of ice on the surface; the northern end is deeper. I saw shells on the bottom, but could see no fish, though the guide said they were plentiful. Ten miles up the Al-lash-ook to the northward and westward, the A-koo-loo-ik River enters the left bank. Still higher up at the bend in the river, the Ping-ing-a-look River comes in on the left bank. At this point the valley narrows to less than two miles and is well wooded; the mountains are nearly bare and steep, with numerous waterfalls running down to the swift and tortuous river here only thirty yards wide.

About five miles beyond, the Koo-to-ark River comes in from the northward and eastward. The configuration of the surrounding heights at this junction is worthy of note. They appear in every conceivable way and shape; there are rugged, weather-scarred peaks, lofty minarets, cathedral spires, high towers and rounded domes; with circular knobs, flat tops, sharp edges, serrated ridges and smooth backbones. These fantastic shapes form the summits of bare, perpendicular mountains.

The Al-lash-ook was followed to a fork near its head and then the Koo-to-ark, a small branch on the left bank, was taken, and followed to its headwaters. The Koo-to-ark River at its junction with the Al-lash-ook is thirty yards wide. It flows from the northward in a tolerably straight course. Coming close down to the water are dome-shaped mountains 3000 feet high, for the most part bare, with here and there little patches of soil with a scant growth. Twenty miles up the Koo-to-ark even this growth practically ceases, excepting at long intervals, when a few poor cottonwoods and willows are found. At one of these spots near the headwaters is the small village of Nimyuk (cottonwood), well up in the mountains. It is a stopping place for deer-hunters and traveling parties.

After thirty-five miles on the Koo-to-ark, I crossed the mountains to northward and eastward over a pass 1070 feet higher than the Koo-to-ark, and came to the village of My-og-arg-a-look. Twelve miles beyond to the northeast, we came to O-co-mon-e-look after crossing a pass 1000 feet higher than the previous one. The road then lay in the gorges over small streams filled with boulders and snow. When ten miles northeast from O-co-mon-e-look, I crossed another pass, unmistakably the work of a glacier, and reached a chain of lakes and the limit of the mountains.

The largest lake, which I named Lake Chandler, after the Hon. Secretary of the Navy, lies between two regular mountain chains, which rise 1050 feet above its level. The shape is regular, running ten miles in length, N.N.E.¼E., and from one mile to 1000 yards in width, and it is so deep that no bottom can be seen. The lake was frozen with ice five feet three inches thick. There is no growth about the shores nor on the mountains. The lakes undoubtedly are supplied with water from springs; the numerous air-holes and cracks indicated this, as well as the bubbling appearance of the water. I was told that this lake rarely froze over completely, ordinarily a strip of water six feet wide remained open all winter. This part of the journey was still harder because of the scarcity of fuel and consequent sameness of food, frozen deer-meat.

When at the head of the last lake I felt the actual need of some warm food and drink. No fuel could be procured, and my alcohol being out, I purchased a sledge for fuel so that some meat could be cooked and tea made. When the former owner of the sledge saw the labor of so many days' hard work being burnt, aroused by his superstitious fears, he became very much incensed. I was afraid for awhile I would have very serious trouble, which indeed, was only prevented by being very positive with the native, saying it was my sledge, and that I could do as I pleased with it.

I reached the lake on March 18, and learned that there were no natives beyond this point until the coast was reached. I again endeavored to get the natives here to go with me to the Point Barrow coast, but they refused, saying, however, that later, when the rivers that flowed to the northward broke, they would take me. Seeing the impracticability of going any further at this time, I decided on returning as quickly as possible, in order to send an officer with these people, some of whom went to the Arctic Ocean every spring. So arrangements were made with them for taking a party later on.

The way back was over the same roads and in pretty much the same weather, with the advantage, however, of its being down hill, allowing better time to be made. Down some of the steep inclines the sleds went so fast as to be entirely unmanageable, overrunning the dogs and piling them up in seemingly inextricable tangles, and, to add to the difficulties, the sleds often capsized, throwing us in every direction. However, no one was hurt, and finally all arrived at Fort Cosmos on April 6, having slept out thirty-eight nights and being for twenty-four days dependent on the country for food. Lowest temperature 48° below zero F.; highest temperature 28° F.

Su-look-pow-wick is the highest settlement on the Putnam. No other settlements were met until I made the headwaters of the Koo-to-ark, where, at Nimyuk, were two huts inhabited by three men, two women and some children. Between this place (Nimyuk) and the lakes, small villages were scattered all along the way, and at the lakes there was quite a large settlement. All these natives living in the mountains are very ignorant, a great many of whom had never seen a white man before. Only a few go to the Arctic to trade, the majority continue in the mountains, living almost entirely on deer-meat. Some of the Putnam River natives pay them annual visits to trade and kill deer; coming from the Putnam in February. The younger people hunt the deer during their stay and all return in April and May. Their movements are slow, because they depend entirely on the country for food, and stop whenever they encounter herds of deer. The route used by them to and from the Putnam is the one I followed.

While traveling on the Koo-to-ark, I met a party of Putnam River natives en route to the mountains. This party numbered forty souls, and had fifty dogs and twelve sleds. Some of these people presented a rather singular appearance, their sleds being drawn by men, women and dogs all hitched up together. A woman with a child on her back and a single dog with three or four puppies playing beside it would drag a sled, while the man behind pushed and guided, yelling at the single dog as lustily as though his team comprised a dozen or more. Some of them accompanied me for awhile, but left to get deer when the heavy weather came on.

The people in the mountains make their huts by plaiting mountain willow to form a frame, which is held up by a few uprights; on the former they put turf and reindeer moss and then cover with snow. The shape is irregular, generally long, low and narrow. Several families occupy a hut, each having its own ice-cake window, smoke-hole, and fireplace. Alongside the doors at the ends there are ice windows. The natives huddle close together under these low roofs that do not admit of standing, and eat and sleep with satisfaction if not with comfort. A special hut was made for me by bending poles to the required shape and covering them with deer skins, leaving an entrance. Over this mould snow was thrown, which froze solid and made a comfortable house. Upon leaving such a hut the poles and skins are taken down, leaving the snow house. This sort of dwelling is often seen along the line of travel in the mountains and affords good shelter in bad weather.

The houses of the natives living on the lakes are generally circular, with curved roofs, made of plaited willow covered with moss and snow, upheld by three or four stanchions six feet long. The smoke-hole is covered with a cake of ice; also the surface entrance to the passage; their scant fuel is from fat and grease. These huts get completely buried by the heavy snowdrifts. I came upon one village of six huts without suspecting their presence. The winds are so severe that snow shelters have to be built for the dogs. At the observation spot on the lakes I left a cairn containing a pepper-bottle in which was a paper stating that I had been there and who composed my party. In order to impress the natives with the sacredness of the cairn, and that it must never be molested by any but a white man, I performed a variety of antics; and Bill, my dog-driver, told them, with much seriousness, that any one who touched the cairn would have his hand rot off, and whoever looked into it would be struck blind.

Expedition to the Hot Springs.

On March 10, 1886, Ensign Reed, with the sailmaker's mate and two natives, left Fort Cosmos with two weeks' outfit, two sleds, and nine dogs, to visit some reported hot springs. The route lay up the Putnam River for ninety miles, then to the An-ne-lag-ag-ge-rack River, and up it to the springs in the mountains at the head of the valley. There was but one hot spring there, a pool twenty feet in circumference and two feet deep, full of water, of blood-warm temperature that wells up quietly from the bottom without bubbles or disturbances of any kind and fills the pool with a clear, tasteless, odorless water; the overflow runs into and fills smaller pools lying lower down the mountain side. The bottoms of all the pools are covered with green moss, on which is a lime-like deposit, and the ground and rocks about the pools are similarly coated. About the edges of the main spring were thousands of small snails. The atmosphere is not affected in temperature, nor are the rocks and ground about. The natives say the temperature of the spring varies; that sometimes it is so hot they can cook meat in it. Mr. Reed was seven days reaching the spring and five days returning. During his entire journey the weather was excessively severe, and the traveling particularly difficult. The highest temperature noted was 12° F., the lowest, —42° F. Gales of wind and snow storms were continually encountered, and much of the road through snow had to be tramped out to make it passable. On March 21, the party returned to Fort Cosmos. The distance traveled was one hundred and fifty miles, which was made in fifty-seven and one-half hours (the time actually under way); the speed was 21.4 miles per day of 8.2 hours, or 2.6 miles an hour.

VII.—The Kubuck or Putnam River.

The large river which I named "the Putnam" on my first visit was called by the natives Ku-buck, signifying "big river." It rises high up in the mountains to the east near the 154th meridian and flows with a general direction of W. by S. into Hotham Inlet through some thirteen mouths. The head of the delta thus formed is some forty-five miles from the coast and it has a frontage on the inlet of about thirty miles.

The Putnam lies in a fine valley of diversified country varying in width from six to twenty miles. On the banks of the river and its tributaries there is a rank growth of either spruce, willow, birch, alder or cottonwood extending back for a half a mile; here and there, mixed bunches of all these woods are formed. Back of the growth is rolling tundra land with hills from 100 to 400 feet high, interspersed with numerous lakes and ponds, generally oval in shape, from three to five miles long, and from three feet to three fathoms deep. There is always a scant growth about them, and in the lower parts of the valley blue-flags and daisies are abundant. The tundra has a growth of grass, some of it resembling wheat and wild oats, reindeer moss, whortle and salmon-berries, flowers, including the wild rose, and occasional patches of scrub bushes. On the river banks wild onions grow profusely, which are especially palatable in the early spring. Trees in some locality extend up the mountainsides to a height of 500 and 1000 feet. Although only in spots on the tundra, the growth of everything is luxuriant for so short a season—June to September.

The country of the delta is flat with an occasional low hill, and numerous lakes and lagoons, with marshes of various sizes, all connected by small streams running in every direction and communicating with the several arms leading to the main stream. Most of these delta channels are too intricate to be followed. Of the thirteen mouths to the river, the smallest and shoalest, with a mud flat at the entrance, empties into Selawik Lake; all the others empty into Hotham Inlet and have mud bars with very narrow channels from three to fourteen feet deep at their mouths. The entrance off Nimyuk sand-spit is the widest and carries two fathoms over the bar, but it soon grows narrow and winding. The main entrance and that most easily navigated lies about one mile west of Selawik Lake sand-spit; it is about fifty yards wide with a twenty-yard channel carrying two fathoms over the bar. After crossing, the entrance widens and deepens, and seven miles above the bar is eleven hundred yards wide, with five fathoms of water in mid-stream.

The width of the Putnam varies from twelve hundred yards to fifty yards, according to the nature of the country; when the valley is broad and the mountains well back the river widens and has many islands, some of them quite large; but as the mountains close in, the river narrows and grows winding; and towards the headwaters it twists and turns, finally becoming a narrow, sinuous mountain stream. Traces in the valley and the many lakes show that the river has often changed its course.

The strength of the current is variable, less at the lowest waters and the widest places than at the narrow bends, and higher up where it attains, around the curves, a velocity of three and five knots; while still higher, rapids and rushing torrents are met.

The banks of the river sometimes rise from the water's edge so gradually as to be barely noticeable; in other places there are foot-hills 150 feet high; while in some parts there is a greater height, of bare perpendicular rock. In two places on the left bank are ice cliffs resembling immense frozen sheets of water, on top of which are six inches of soil with a scant growth of spruce and willow.

Where the banks are highest, the back country is most rolling, with a scant growth of spruce and scrub, but an abundance of whortle, salmon and blueberries and reindeer moss. These high banks are sometimes rocky and sometimes of different kinds of clay. Usually a narrow beach of sand or gravel makes out from them. Low banks have wider sand beaches, and in some places there is no beach at all. Near the headwaters, where the river runs close to the mountains, the banks are nearly perpendicular; and a geological formation of slate with quartz, in strata inclined at an angle of about 45°, is easily seen.

About two hundred and fifty miles up, boulders are seen on the banks, becoming more and more numerous as one goes up, until, at a distance of three hundred miles, they are found in mid-stream with the water swirling about them; thirty miles higher they become very numerous and dangerous. About forty-five miles up the river, sand-banks first make their appearance, gradually increasing in number and extent towards the source. Some of these stand well out of water, deflecting the channel to one side or the other. The depth of the Putnam River is quite regular with deep holes here and there its entire length. Beginning at four and a half fathoms, it gradually shoals to one fathom near the Par, three hundred miles up and then grows less. A slight tidal influence was noticeable the first forty miles of ascent, none higher up. The current always sets out.

The mountains are in ranges, groups and semi-detached groups of every shape, indicating their formation at different times and under different circumstances. This range is an upheaval, while its neighbor is a compression; some are well-defined, with round surfaces and a thick growth; others are rugged, scarred and bare. The range on the south side of the valley is the lower, and is in scattered groups, connected by chains of hills, which grow into and form a regular chain of mountains as the valley is ascended. On the northern side the line of mountains is nearly continuous, with many streams running down the valleys to join the main river; on the southern side these streams are noticeably few until many miles up from the mouth.

About one hundred and sixty miles above the mouth, the Ambler, or Nut-vuck-to-wo-ark River, the largest tributary, enters the right bank. It rises in the mountains separating the valleys of the Putnam and Notoark, and is for many miles a rapid mountain stream, winding down in a southerly direction through a valley of its own. Where the valley narrows, the banks rise into towering perpendicular cliffs, and the waters tumble and roar over great boulders. The southerly course is held until within twenty miles of the Putnam, when, the valley opening, the stream turns sharply and runs parallel to the recipient, separated from it by a low range of mountains. By another sharp turn it enters the Putnam at right angles. The valley of the Ambler River is well wooded with spruce, willow, birch and cottonwood, extending well up the mountainsides. The route by this valley is one of the ways of communication between the Notoark and Putnam countries.

About three hundred miles up the Putnam the first large and important tributary from the southward comes in. Its name is "Par," meaning door, because it is the route that leads into the Yukon country. It is a tortuous stream of one hundred miles in length, rising in the mountains to the southward, and running its last forty miles at right angles to the recipient.

Above the Par River many tributaries enter at right angles to the Putnam, but they are too small for any extended navigation beyond their mouths. About ten miles above the Par, the Su-look-pow-vuck-to-ark River enters from the north. It is the outlet of Lake Selby. The native village at its mouth is known as Su-look-pow-wick on account of the quantities of small fish of the same name that are caught here. About thirty miles above the Par, the An-ne-la-gag-ge-rack River comes in from the north by a mouth one hundred yards wide. A high, densely wooded bluff marks the left side of the mouth, and a low, sparsely wooded one, the right. From its source the river runs in a general south-easterly direction for sixty miles through a narrow valley of high mountain ranges ending a few miles above the mouth. Its windings are many and in all directions though of no great length. At the head the valley narrows to one-half a mile with the mountains beyond in which lie the hot springs described elsewhere.

Above the An-ne-la-gag-ge-rack River, the Putnam valley narrows, and the river gets more winding and full of boulders, and the banks are high. The growth is thick, particularly the spruce, which in these higher lands has smoother bark and softer leaves. The mountains are in ridges from 1200 to 2800 feet high and wooded to an altitude of 1000 feet. Proceeding, the river narrows to thirty yards, making the first rapids through a cut in a cross-hill whereon the growth is scant. Going on up, the river widens and the same growth appears as before, meeting the narrows. A curious phenomenon hereabouts is the spruce growing in and out among the rocks with its roots above ground. Still higher, the second rapids are met rushing in a fifty-foot cut through a hill, over and around huge boulders. Above the second rapids the valley opens to ten miles in width; the mountain chain, 2500 feet high on the right hand, and nearer groups 1600 feet high on the left, swing into the high range running northwest and southeast and form the head of the Putnam valley. Among these high mountains, many little streams rise, and, flowing down, meet in the valley to form the Putnam River.

The Putnam River freezes in October and opens in June. The following account is from the observations made at Fort Cosmos. On September 13, ice made on the lakes; on September 23, on the creeks; and on September 25, along the banks of the river and at the headwaters, and drifted down occasionally, jamming and then passing on. By October 18, the river was frozen solid. On the first of each month the thickness of the ice was measured to ascertain the amount made during the month and also the total thickness; and there was a hole kept open to find out the amount made in twenty-four hours. The greatest thickness measured for the winter was five feet eleven inches; in the month of February, five feet four inches made; the maximum thickness made in twenty-four hours was four inches, the minimum one-half inch. The current under the ice was measured and the greatest speed found was 1.6 knots, the least .9 knots. The water under the ice rose and fell all the season, varying from one inch to two and a half inches a day.

The breaking up of the river was interesting. It began at the headwaters by the water forcing its way through cracks and flowing over the ice for miles. At Fort Cosmos on April 29, the ice suddenly became covered with water a foot deep, increasing on both sides of the river and decreasing towards the middle. On May 19 the ice cracked along both banks and the main body in mid-stream rose to the surface, then the ice along the banks began breaking away and rising to the surface. After May 20, large pieces broke from the sides of the main pack and, flowing down, left channels near both banks; the water would now rise and fall one inch to three inches an hour, caused by jams above and below. This lasted until May 30, when the whole mass moved two hundred yards and then jammed, causing the river to rise five inches in fifteen minutes. It then moved lower down and jammed again, and so continued all day, the water rising when the ice stopped and falling when it moved. June 1 the ice moved all day, sometimes filling the river with large cakes and sometimes leaving it nearly clear.

On June 6, the river was clear. The ice on the smaller creeks did not break. They were frozen solid to the ground and the water flowed over the ice which by degrees melted away from the top. With the last of the ice came a large amount of drift-wood and some large trees. Though the river was clear by June 6, the ice remained in Hotham Inlet as late as July 8.

Lakes.

The principal lakes connected with the Putnam River are Lake Selby, Now-tow-vuck-toy, and Lake Walker (Kal-lu-look-to-ark), on the northern side of the river, and Lake Now-get-to-ark on the southern. Lake Selby is of glacial origin, shown by the peculiar formation of the banks and islands. It lies between two mountains 2000 and 3000 feet high, is five miles long and three broad, of an oval shape, and quite deep, in places no bottom at eighteen fathoms. The long axis is north and south. There are two islands near the lower end. The water is fresh and said to abound in a species of salmon. The outlet to the Putnam is the Su-look-pow-vuck-to-ark River. Lake Now-tow-vuck-toy is quite similar. It is eight miles long, bare of islands, and its major axis is nearly parallel to the Putnam. Its outlet has the same name. Lake Walker, Kal-lu-look-to-ark, or "Big Fish," lies in a valley among mountains 3000 and 3600 feet high and is surrounded by hills 150 to 350 feet high. The length is fourteen miles, running northwest and southeast, and the width three to six miles. In the center of this lake, and near one another, are three small rocky islands. Fish abound. The outlet is a small stream, entering the Putnam. On the southern side of the Putnam valley is Now-get-to-ark Lake (Gull Lake), a round lake of four miles diameter. It is the breeding place of the gulls; millions of them nest on its shores. The outlet enters the Putnam at the first narrows. The above lakes lie well up from the sea. In the lower part of the valley they are more numerous, and of all sizes, shapes and depths. They lie scattered about between the foot-hills of the tundra, often connected, making chains of lakes and ponds, some with no visible outlets, and others with rivulets running to the Putnam. Here and there all through the valley are little springs of good fresh mountain water. There is only one hot or warm spring.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE SIGHTING OF CERVERA'S SHIPS.

By Lieutenant Victor Blue, U. S. Navy,
Of the U. S. S. Suwanee.

Sunday morning, June 5th, the U. S. S. Suwanee, Lieut-Comd'r Delehanty, joined Admiral Sampson's fleet off Santiago. She had on board arms, ammunition, and supplies which had been taken from the transport Gussie, and which were to be delivered to the insurgent army on the south side of the island of Cuba.

Captain Delehanty immediately opened communication with a part of the insurgent army under Colonel Cebreco, operating near Pt. Cocal, and with the main body under General Cebreco, whose headquarters were near Aceraderos, nineteen miles west of the entrance of Santiago Bay. The location of Pt. Cocal and of Aceraderos may be more readily fixed in mind when it is remembered that they are marked by the wrecks of the Maria Teresa and the Viscaya respectively.

After passing the night on her blockading station off Santiago, the Suwanee would go to one or the other of these places and remain for the day, while her boats were engaged in landing supplies for the insurgents. Thus her officers became well acquainted with the Cubans and familiar with the localities where their camps were situated.

On the morning of the 10th, one of the auxiliary vessels coming from the flagship hailed the Suwanee through the megaphone and said that the Admiral directed us to communicate with the insurgents at once and ascertain positively before night whether or not all of Cervera's ships were in the harbor. Immediately the Suwanee was headed for Aceraderos; and on the way to that place Captain Delehanty talked the matter over with me. His idea was that, in order to obtain reliable information, an officer should make the trip, accompanied by a Cuban guide, to some point where a clear view of the bay could be obtained. The intention was to pick up a guide at Aceraderos and return to Point Cocal, where the officer and guide would be landed. It was thought that they could climb one of the high hills in that vicinity, view the harbor, and return on board in time for the Suwanee to reach the flagship off Santiago before nightfall. This plan semed very feasible, with little or no danger attached to it, and it was with a light heart that I set out for General Cebreco's headquarters to procure a guide, all the while entertaining pleasant anticipations of seeing that day the wonderful squadron of Cervera's, about which so much had been said and written. General Rabi, who had arrived the day before, being senior to Cebreco, was found to be in command. He received me very kindly and courteously, and after hearing my plan, replied at once that it was impossible; because, as he said, the Spaniards had only the day before driven the Cubans back from Point Cocal, and were probably at that moment half way between that point and Aceraderos.

After a consultation with Cebreco and several scouts who had recently come into camp, he informed me that there was a place to the northward of Santiago where it was possible to go through the enemy's lines and approach near enough to the bay to obtain an unobstructed view of it. "But," he said, "you cannot make the trip in less than two or three days; a Cuban can make it in two by riding night and day." There being no ostensible reason why an American should take a longer time than a Cuban to make the trip, Rabi's plans were accepted, a note was sent by the coxswain of the boat to Captain Delehanty, apprising him of the changed conditions of affairs and informing him that I should return in two days' time. Preparations were at once begun for the journey. Rabi's mule, the largest at the camp, was made ready for me. By this time many officers had grouped themselves around the general's tent and seemed to take much interest in the proceedings. A suitable guide had to be found, and a number of officers volunteered their services. Major Francisco H. Masaba-y-Reyes was selected, and no better man for the work in hand could possibly have been found. In appearance he was a dark mulatto, with bushy black hair and whiskers, keen black eyes and fierce countenance. His gruff voice was seldom heard except in monosyllabic oaths at his mule when this unfortunate animal would reach for a blade of grass along the road. He was not a person that one would select on short acquaintance for a traveling companion on a pleasure trip through a lawless and lonely country.

As we were on the point of starting, the Suwanee fired a gun and hoisted a flag at the fore. This was the pre-arranged signal for me to return. I assumed that the captain wished to acquaint the Admiral with the unexpected condition of things before allowing me to proceed, and therefore asked General Rabi to have everything in readiness for the journey the following morning. When I returned on board, the Suwanee steamed back to the fleet. Captain Delehanty went on board the flagship and came back with the order for me to proceed. So the next morning found Masaba and me steering a course for the hills back of Santiago.

The Cubans had disapproved of my wearing uniform as, they said, there was no chance of success if we were seen and recognized by the Spanish troops, and that if we were seen at a distance the uniform would cause them to recognize us at once; whereas, if my costume was that of a Cuban they would mistake us for "pacificos" unless we actually fell into their hands. The Cubans contended that there must be "catching before hanging," while I preferred to run the risk of dodging a few Mauser bullets from poor marksmen rather than the certainty of a halter if we were captured.

From Aceraderos our route ran four or five miles in the direction of Point Cocal in a mule path cut through an almost impenetrable jungle that covered the slope between the mountains and the sea, then to the northward we followed the course of a mountain stream that was the dividing line between the insurgents and the Spaniards. The journey through the jungle and over the mountain range was without incident, except for a few interesting moments passed in ascertaining whether an occasional challenge that rang out sharply from some hidden retreat came from a friend or an enemy; for, as this was neutral ground, there was a possibility of encountering Spanish pickets. On occasions of this kind, however, the suspense was only momentary, as after a few minutes' parley at a distance we always found our challengers to be Cubans. In order to show the difference between the Spanish and the Cuban methods of warfare, it may be mentioned here that during the entire trip of seventy miles not one Spanish picket was seen, notwithstanding the fact that Spanish troops in considerable numbers were occasionally passed. The Cubans, on the other hand, were always on the alert, and not once in the many times we passed in and out of their lines did their vigilant pickets fail to challenge us.

While descending the northern slope of the mountains we obtained our first view of the Spaniards. Masaba, who was riding ahead, suddenly spurred his mule into a run and motioned me to do likewise. It did not take many seconds for me to understand this action of Masaba's; for glancing to the right I saw a Spanish camp on the hillside about six hundred yards away. The soldiers were lying around the tents, apparently unconcerned. It is needless to say that we lost no time in crossing the 200 yards of bare space that lay ahead of us.

On this side of the mountains there were many evidences of the devastation wrought by the Spaniards since the beginning of the insurrection. Coffee, cocoa, and sugar-cane were growing in abundance; but had been uncultivated for a year or more. Houses had been burned, and the small sugar-mills destroyed. Only old men, women, and children were seen. All the able-bodied men had gone to the woods and joined the insurgents.

Shortly before sundown we reached the headquarters of an insurgent battalion posted on the road that led from Santiago to Manzanilla, the same road over which Colonel Escario's column afterwards succeeded in reaching Santiago. General Rabi had sent a letter by Masaba to the colonel of this regiment directing him to give us all required assistance for passing through the enemy's lines. The colonel called a number of his scouts to conference, and the situation was talked over. The insurgents estimated that there were about 700 Spanish troops posted in various places guarding the roads that passed through that locality. Small detachments of the enemy were constantly moving back and forth through the 15 miles of country that separated the Cuban forces from Santiago Bay; and on account of the dense growth on the hills and in the valleys, the problem was to find a trail over which we could reach the bay without falling in with Spanish soldiers. After considerable discussion among the scouts a route was decided upon, and our party, which had been increased by three soldiers on foot, left the Cuban camp, and much to my surprise took the main road towards Santiago. How they expected to go through the lines unseen on that road was more than I could understand, but as I knew nothing of the country it only remained for me to follow blindly and say nothing. We followed this road for about one and a half miles, and after descending a hill left the road and plunged into a dense forest, which seemed almost impenetrable from the outside. Just as we were leaving the road about 20 Spanish soldiers emerged from the woods on the hilltop 200 yards behind us. We were informed of this the next day by a "pacifico" who happened to be on the hill at the time. As we did not see the Spaniards, it is safe to assume that they did not see us.

Soon after leaving the forest night came on, and it was necessary to dismount and lead the mules as we felt our way through the darkness, stumbling over logs and sinking knee-deep in mud. After crossing a small stream, Masaba, who had been more quiet than usual, turned to me and said, "we are now in the enemy's country." Two hours' time was consumed in passing through the swampy jungle when more open country was reached. The guides found a trail, which we followed for about half a mile, when they concluded that it was unsafe to go farther that night. As we had twelve miles to travel before reaching the bay, my desire was to get there before daylight. The Cubans, however, replied that, on account of the Spaniards constantly changing their positions from day to day, it was absolutely necessary to proceed in the daytime, when we could see our way ahead and also obtain information of the enemy's whereabouts from the "pacificos" who lived in that district. After deciding to wait until morning before proceeding farther, we left the trail and began to look for a suitable place in the woods in which to sleep. A light was seen several hundred yards away, and one of the soldiers was sent ahead to reconnoiter. He returned after a while and reported that the light came from a house in which a half-breed Frenchman, who was a Cuban sympathizer, lived. This man and his wife proved to be very hospitable as far as their scanty means would allow.

They told us that had we followed the trail a half-mile farther we would have fallen in with a detachment of Spanish soldiers that had taken position there that afternoon. From that time on my faith in the wisdom of the guides increased. After making a supper on some dried beef and coffee, furnished by the Frenchman, and hard tack and sardines from my haversack, the three soldiers were posted as sentries and Masaba and I retired for the night. It made no difference that my bed was a brick floor and that the air was thick with mosquitoes, the fatigue of the day's journey made me oblivious to things so trivial. I was waked in the morning before daylight by inhaling the smoke from a wood fire in the middle of the room, where the Frenchman's wife was making coffee.

We started soon after daylight on a road recommended by the Frenchman, who said it had been occupied by troops until the previous day, when the detachment moved elsewhere, and that if we got an early start we could pass over a certain distance before the arrival of another detachment expected from Santiago. We had not gone far before we heard the sound of musket firing in the woods on our right and rear, the result of a skirmish between the Spaniards and the insurgents we had left the evening before.

On the road we met from time to time quite a number of "pacificos," all of whom seemed to be loyal Cubans who were anxious to give us information as to how we should proceed in order to avoid the Spanish soldiers. In fact the advice given by these people prevented our falling in with troops on several occasions.

In order to explain our mission and perhaps to magnify the importance of it in the eyes of these ignorant people, Masaba told them that I was going in to destroy the Spanish fleet with dynamite. I think he even went so far as to tell some of them that I was Admiral Sampson, as on our return trip several of them asked me if I was the Admiral.

As we advanced towards the bay, changing our route from time to time as advised by "pacificos," we occasionally saw camps of Spanish troops on our right and front. Finally, ascending a hill, Masaba dismounted and told me to do the same. As we led our mules up to the crest and peered over we saw before us a hundred or more of the enemy's troops lounging about their camp at the foot of the hill. But what was a more inspiring sight was the city of Santiago and the bay. We were looking down on the deck of one of Cervera's cruisers of the Viscaya class. Some distance down the bay was another of the same class. We reached the crest of the hill just in time to see one of the destroyers disappear behind Smith Cay; the other was steaming down the bay.

It was a beautiful Sunday morning, clear and warm. A gentle breeze blowing from the eastward somewhat counteracted the rays of the tropical sun. The two armored cruisers were lying peacefully at anchor with awnings spread; their boats quietly swinging at the booms, and their colors waving in the breeze. Near the city were a number of steamers, among which was the trim little gunboat Alvarado. I was deceived in thinking two of these steamers were small cruisers on account of their neat appearance; one, in particular, the Mexico, with her elliptical stern and quarter-boats might have deceived the most practiced eye.

From our position on the hilltop the two destroyers and two armored cruisers of Cervera's squadron had been seen; but where were the other two? Could it be possible that the rumor was true that they had not gone into Santiago? There yet remained to be examined certain parts of the bay that were shut from our view by trees on the intervening hills.

Proceeding in the direction of the city for about half a mile we climbed another hill several hundred feet higher than the first, and from there viewed the third armored cruiser. This disposed of the Maria Teresa, the Viscaya and the Oquendo. From this place of observation nearly the entire bay was in plain view, but the Cristobal Colon was yet to be found.

The western part of the bay south of Cay Ratones was still closed, and in order to open it out, it was necessary to retrace our steps and go several hundred yards beyond the first place of observation towards the sea. While going in this direction, and stooping in high grass in order to conceal ourselves from the Spaniards, whom we were gradually approaching, suddenly a military mast loomed up among the treetops, then a smoke-pipe, and finally the hull of the Colon came into view. Our work was finished; the desired information had been obtained, and it now remained for us to return to where the mules had been tied, and then to get across the twelve miles that lay between us and the Cuban battalion as soon as possible. While returning we found that news of us had gone abroad among the "pacificos." But loyal as they were, they kept their knowledge from the Spaniards until we were well out of harm's way. After the war a Spanish officer told me in Santiago that the Spaniards heard of this reconnaissance the day after it was made.

On returning, our intention was to pursue the same route over which we had come, and this we accomplished for a distance of seven or eight miles, when we were stopped by an old man who gave the startling information that Spanish soldiers were on the road ahead. As this was the only road known to be clear of troops early in the morning, we decided to disperse. Masaba and I struck out through the woods in a southwesterly direction, leaving the three soldiers to look out for themselves.

For four or five miles we traveled through a rough and broken country, sometimes in thick underbrush and sometimes in the open, occasionally taking a road, only to leave it again when advised to do so by the "pacificos." All along this route desultory firing was heard on our right and left, but no Spaniards were seen.

About nine o'clock that night we arrived at General Rabi's headquarters at Aceraderos, and the next morning at daylight the Suwanee's whaleboat met me at the landing according to the pre-arranged plan.

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THE TAKING OF ILO ILO.

By Lieutenant A. P. Niblack.

With all the hundreds of islands and the numerous mixed and indigenous people in the Philippine and Sulu archipelagoes, the whole question, political, commercial, geographical, and strategical, may be simplified by regarding the Philippines as divided into three groups or districts, and the Sulu archipelago as constituting a fourth. These four groups are, roughly:—

1, Luzon and Mindoro Islands, in the North, with an area equal to Ohio, and a population of 3,500,000.

2, The Bisayan district, between Luzon and Mindanao, a belt of islands from Palauan on the West to Samar on the East, inclusive, and also Calamian, Panay, Negros, Cebu, Bohol, Masbate, and Leyte with an area equal to Kentucky and a population of 2,500,000.

3, The Island of Mindanao with an area equal to Indiana and a population of 500,000.

4, The Sulu archipelago with an area less than Rhode Island and a population of 100,000.

The primitive people of the islands are generally supposed to have been the Negritos and numbering about 10,000. They are found now only in the islands of Luzon, Panay, Negros, and Mindanao, and resemble the Papuans of New Guinea. They are known also as the "hill-tribes," having been driven into the interior by the Malayan invaders. Their principal weapon is the bow and arrow, and, as they are rapidly disappearing, they are not a political factor.

Fully eleven-twelfths of the native population of the archipelago is of Malayan blood and the number of dialects or separate Malayan languages spoken is about fifty.

The Tagalas of central and southern Luzon are comparatively a pure Malayan type and have been the real instigators of the insurrection; the Bisayas are more industrious, more gentle, and more adaptable. The sentiment between them and the Tagalas is not friendly.

The principal tribes of Mindanao and the Sulus are of the Mohammedan faith, and are known as Moros. They are of mixed Semitic and Malayan stock and evidently invaded the islands from Borneo. Between them and all other tribes there has been continued warfare, as they are a treacherous, indolent, fanatical race, given to robbery and violence.

The island of Mindoro, which should not be confounded with Mindanao, is really a part of Luzon in the sense that its population is of the same stock and all its trade is with Manila and ports on Luzon adjacent to its own shores.

The northern part of the island of Luzon, cut off as it is from the central by high ranges of mountains, is peopled by numerous tribes of mixed races varying in different proportions of Malay, Chinese, Japanese, and Negrito. They are not all friendly, by any means, either with one another or with the Tagalas. The point which it is endeavored here to bring out is that the insurrection was initiated by the Tagalas. Hostility to us in other parts has been largely due to their emissaries and their intrigues. The talk of a "Filipino Republic" is a Tagala dream. How they are to dominate the hundreds of islands without a large navy, and how representation could be effected and harmony brought in a legislative assembly where from twenty to thirty languages must be spoken, has not as yet been made clear.

Spain has held the islands for three hundred years, and why the Tagalas should dominate since they too are invaders of an earlier period has also not been made clear as an ethical proposition. Sentimental sympathy for the struggling but designing Tagalas should be largely confined to their own ranks.

Ilo Ilo is the capital of Panay, possesses a fine harbor, and is the principal port in the Bisayan group, being commercially next in importance to Manila, and also the headquarters of the sugar trade.

Cebu, the capital of the island of the same name, was the first town occupied by Magellan, in the name of Spain, in 1521, and is now third in importance commercially, being the center of the hemp trade.

Not much is known of the island of Mindanao except by hearsay, as Spain pursued the singular policy of prohibiting exploration and forbidding publication of accounts of the island. Enough is known to stimulate enterprise and attract adventure. Unfortunately, the Moros are a fanatical, fierce, lazy, uncertain, unsociable, and unscrupulous race, and they must first be dealt with. There are two large placer gold-mining districts in the north; the island is remarkable for its timber; it is said that it has everything which grows or is found on the other islands, and, besides, nutmegs, cinnamon, pepper, and other spices which thrive as nowhere else. If this is true, then Mindanao must be rich indeed, since the Philippines in general can boast of sugar, hemp, cotton, rice, tobacco, coffee, wax, timber, sapan wood, indigo, copra, spices, pigs, chickens, cattle, hides, sulphur, iron, coal, marble, kaolin, lead, mercury, copper, silver, gold, platinum, pearls, mats, textiles, hats, cordage, etc., etc., as natural and industrial products.

As for the Sulu group, the Spanish have never been able to collect any revenues and their occupation has only been effective in the last few years. They had military garrisons in three principal islands, Tawai-Tawai, Sulu, and Basilan, the last-named being a naval station. From this naval station across Basilan Straits to the Spanish garrison town of Zamboanga on the island of Mindanao is only fourteen miles. Spain has now withdrawn all her garrisons in Mindanao to Zamboanga, and we shall have to make a fresh conquest of the whole island. As to the Sulu archipelago in particular we shall be obliged to police the islands by means of gunboats. The Dutch have a talent for handling these East Indian people and besides have native troops and native police. We shall never be able to make anything out of the Sulus and they will prove a veritable white elephant. If we could exchange them with Holland for the island of Curaçoa in the Caribbean Sea, for a consideration, we should be fortunate and it would also secure us a good neighbor in the Philippines.

Practically the five centers of interest in these islands are Manila, Ilo Ilo, Cebu, Zamboanga, and Sulu, the latter being the garrison town on the island of the same name, and former residence of the Sultan of Sulu who was practically deposed by the Spaniards.

The First Expedition to Ilo Ilo.

The first expedition to Ilo Ilo from Manila sailed from the latter port on Tuesday, December 27th, 1898. With the fall of Manila and the signing of the Peace Protocol in the previous August, the United States was under the moral obligation to make no further change in the *status quo* in the Philippines. It appears, however, that the continued activity of the insurgent troops against the Spanish garrison of Ilo Ilo, now cut off from direct reenforcement and succor, had led the Spanish Commander, General Rios, about the middle of December, to declare his intention of evacuating the city and withdrawing his troops to Zamboanga in Mindanao. The merchants of that city, none of whom were Americans, petitioned General Otis to send an expedition to relieve the Spanish garrison. At the same time the insurgents made a similar request. Had a prompt answer been given General Otis from Washington, Ilo Ilo might have been occupied with the consent of the people. It was eight days before instructions were received and it is said that the orders were "*to take Ilo Ilo, but do nothing which would bring on a conflict with the natives.*"

The expedition which started, as stated, on December 27th, consisted of the transports Newport, Arizona, and Pennsylvania, on which were embarked respectively a battalion of the Sixth U. S. Artillery, the Eighteenth U. S. Infantry, and a regiment of Iowa Volunteers, which latter had left San Francisco some months previously and had never been disembarked. The expedition was commanded by Brigadier General Marcus P. Miller, U. S. Volunteers, but holding a commission as Colonel in the regular army, a popular officer of ripe age and experience. The expedition was in every sense an *Army* affair, although the U. S. S. Baltimore acted as convoy. The Admiral opposed the proposition to send the expedition when it was originally contemplated; and after orders came to send it, he predicted its failure for the very reason that it did afterwards fail. To take a place without hurting anybody's feelings, particularly in the Capitol at Washington, is not an easy matter, and General Miller's position was not an enviable one.

On December 21st General Rios had called a meeting of the foreign consuls at Ilo Ilo and told them that he had a telegram from Spain saying the islands had been acquired by the United States and that he did not feel justified in sacrificing Spanish soldiers in nightly encounters with the insurgents. He therefore announced his intention of withdrawing his forces and turning the town over to the Spanish *alcalde*, requesting the foreign consuls to protect foreign property. He entered into negotiations with the insurgents to capitulate, with the understanding that he should be allowed to carry away all the government property he could.

On Saturday, December 24th, the Spanish troops left Ilo Ilo for Mindanao. The German cruiser Irene took over the protection of foreign interests, but the universal testimony is that the insurgents in entering the town behaved in the most exemplary manner. The Spanish *alcalde* turned over the city to them and is credited with the remark that he hoped they would "be able to defend it against all invaders."

Many people are inclined to think the Spaniards acted in bad faith in the matter, but the position they were in was really thankless. Had we sent an adequate force at once when requested we could have assumed peaceful possession. The delay was responsible. However, the action of the Spanish General raises a nice point in international law as will be seen later.

The expedition sailing from Manila met at sea the regular mail-steamer from Ilo Ilo, and, on communicating, learned of the situation there. On the arrival of the Newport and Baltimore, the other two ships remaining outside, a delegation of insurgents came on board to ascertain the intentions of General Miller and the purposes of the expedition; also what recognition was going to be given them. General Miller promised to write them a letter next day explaining his position.

Mr. F. J. Bass, who was special correspondent of "Harper's Weekly," and who was, with permission, on board the headquarter's transport, the Newport, says in his account of the expedition printed in the issue of March 18th, 1899, page 268, speaking of the day of arrival:—

"I went on shore and found only a few soldiers in the town. The old fort was unoccupied. Certainly, had we landed then and asked permission afterwards, our explanations would have received more serious consideration than they did. Nearly all of the insurgent troops were two miles distant, across the river, at

Jaro. The insurgent flag was down, and the insurgents evidently expected us to land. I am persuaded that we made a mistake in not landing then and there. . . . When I landed at Ilo Ilo, I think a dozen men might have raised the United States flag without much difficulty. I staid in the city five days. At first I was treated with respect and allowed to go wherever I pleased. Little by little a change came about. With every communication we sent, with every evidence of hesitation we showed, the insurgents gained confidence, until, at last, I was obliged to leave the town on account of their hostile attitude; . . . gradually they took heart and began to fortify the town. They took possession of the old fort, and threw up earthworks along the strip of beach. . . . When I left Ilo Ilo for the Newport there were two thousand armed men in town, who patrolled the place constantly. The streets were being barricaded."

The letter which General Miller had sent on shore was in conformity with his instructions. He stated that his expedition had come expecting to take the town from the Spanish, and he did not wish to have any trouble with the insurgents. It ended by stating that he had come on an errand of peace, and wanted to know what the insurgents would do if he landed. Messages and visits were exchanged, the insurgents first requesting and then demanding time to send to Manila to consult Aguinaldo. The fact is the emissaries of Aguinaldo were then at Ilo Ilo stirring up all the trouble.

Mr. Bass says:—

" General Miller, an old Indian-fighter, who had chafed under his restricting orders, now openly declared that he had come to take Ilo Ilo, and was bound to do it; that he wished to avoid bloodshed, but as the insurgents were not open to advances, they must take the consequences." . . . " The guns of the Sixth Artillery were lowered into boats, the Eighteenth United States Infantry was in marching order ready to land; the Iowa Volunteers prepared to follow."

The landing did not take place, for the merchants of Ilo Ilo, learning that the insurgents intended to burn the town, petitioned the General not to land. The proclamation of the President and the special version given by General Otis were brought down by a foreign man-of-war. Then the insurgents determined to fight. All this happened in the three days following the arrival of the expedition.

General Miller then sent Col. Potter to Manila for orders. Admiral Dewey at once sent the gunboat Petrel to Ilo Ilo with instructions for the Baltimore. Her arrival was signalized by the insurgents sinking four large iron dredging scows, loaded with stone, in the mouth of the river, to block any attempt she might make to enter. Meanwhile all non-combatants had left the town, taking with them all their household goods. The merchants had loaded as much of their property as they could on lighters, and towed them out of danger across the bay. They themselves took up quarters on the various steamers in the bay, and it looked like war.

Meanwhile a regiment of California Volunteers was embarked on five chartered steamers at Manila as a reenforcement for Ilo Ilo and the Concord detailed as convoy. After some twelve days' delay they were disembarked and a few days later their baggage and stores were sent on shore. The expedition was then definitely abandoned.

On January 31st the transport Pennsylvania returned to Manila and landed the Iowa regiment which had been on board nearly four months. The *status quo* as to ships and transports remained the same at Ilo Ilo for six weeks, while the ratification of the Treaty of Peace was pending in the Senate.

The Second Expedition to Ilo Ilo.

There was in a certain sense no "second expedition" to Ilo Ilo. The Boston replaced the Baltimore and the St. Paul brought down the Tennessee Volunteers. This happened as follows:—

The sending of the Commissioners to the Philippines and the necessity for sending a suitable man-of-war to Hong Kong to meet them led to the relieving of the Baltimore at Ilo Ilo by the Boston in order that the former might perform this duty. It was my good fortune to be transferred at this juncture to the Boston as Acting Navigator during the illness of another officer. She sailed from Manila the day after the breaking out of the insurrection at Manila early in February with a full knowledge that orders would follow later to take Ilo Ilo. Arriving on February 8th she relieved the Baltimore which sailed immediately. On February 10th the Army dispatch-boat Butuan arrived at Ilo Ilo bringing Col. Potter with news of the ratification of the treaty and orders to take the place. By direction of General Miller a conference was held on the Newport at 1.00 P. M. of that day. It was announced that the transport St. Paul would arrive in the evening with the Tennessee Volunteers. It was decided that the insurgents should be given till sunset of the 11th to evacuate and to be notified also that if in the meantime they threw up intrenchments, reenforced their defenses, or put further obstructions in the river, the men-of-war and transports would open fire at once. It was also agreed that the Army should use two of their own steam-launches and a third small steamer, expected that night, to tow their boats for landing. Captain G. F. F. Wilde, U. S. Navy, commanding the Boston, and Commander C. C. Cornwell, U. S. Navy, commanding the Petrel, stood out for only twelve hours' notice or till daylight, but General Miller overruled and decided for sunset next day as the hour to be named. Notification was accordingly sent ashore to the insurgent forces at 4.00 P. M. of the 10th and the Boston and Petrel cleared ship for action and moved over near the fort in such position that each could drop shells into the flank of the trenches facing the other ship (see diagram) without firing in the direction of the town. The Petrel was 500 yards and the Boston 900 yards from the center of the fort.

At daylight next morning a reconnaissance by the Boston's steam-launch close in shore showed everything quiet, but the Petrel reported a movement of troops in the fort, apparently an attempt to relieve the garrison. At 8.20 A. M. she signaled "Troops are throwing up intrenchments on the beach." At 9.00 o'clock she fired two warning 3-pounder shell at the new trenches killing several people. This of course precipitated matters. Troops poured into all the trenches as reenforcements and a field piece came into line while several generals rode back and forth on ponies busily giving orders. It will be noted that the insurgents violated the order in intrenching themselves and reenforcing their trenches. Captain Wilde took full responsibility for the Petrel's action by signals which were almost continuously exchanged.

At 9.35 A. M. the insurgents began firing on the Petrel at close range, and she opened fire followed by the Boston. It was not long before the fort and trenches were untenable and by two's and three's they slipped away, setting fire to the town and looting as they went. Then two riderless ponies appeared coming out of the fort and several generals crawled behind sand-bags and crossed the zone of fire to join their fugitive troops. A masked battery on the other side of the river, consisting of a few antiquated cannon, opened fire on the Newport early in the action and in replying some of her shell evidently fell into the business part of the city. This is mentioned, because, in retaliation for setting fire to the town, the Boston commenced from the first to drop an occasional eight-inch shell over the city into Jaro and Molo, two native towns near Ilo Ilo, and kept this up till after two in the afternoon. It was said that some of her 8-inch shells must have exploded in the air. As the shells complained of were afterwards found to be a caliber of about three inches, they came from neither the Boston nor Petrel, and did correspond with the Newport's battery. Soon after the original firing began, Captain Wilde had signaled General Miller that the insurgents were throwing up intrenchments and firing on the Petrel. At 10.20 General Miller signaled "Do you desire landing party now?" and when replied to in the affirmative signaled "If you desire landing party send steam-launch and three boats to Arizona for towing and landing." As the Arizona and Newport were anchored fully a mile and a quarter from the fort with a strong flood-tide against them, as Captain Wilde had strongly advised moving closer, and as it was distinctly agreed that the Army should tow its own boats, Captain Wilde saw that the city was in danger and acted promptly. A section of infantry under Ensign Everhart and a gatling section under Ensign Hough, with Asst. Surgeon Blakeman and a couple of signalmen, were prepared for landing. Just then the Army launch Samar came alongside with General Miller and all his staff on board and General Miller asked Captain Wilde if he thought the troops should be landed. Captain Wilde's reply was not particularly soothing in its character but was strongly affirmative. He ordered the men from the Boston to be landed at once and signaled the Petrel to land a squad in support. Being permitted to command the Boston's landing party of some fifty all told, not counting two or three who sneaked in at the last moment, it is a great pleasure to state that we landed according to the drill-book, we deployed according to tactics, and we shinned up the wall of the fort with the best man first, and found the fort deserted, except by one of the ponies of the numerous generals. We hauled down the insurgent flag and hoisted the Stars and Stripes in the Bisayas, let us hope never to come down again. The Petrel's men had meanwhile occupied the trenches, where we then joined them. On comparing notes with Lieutenant Plunkett, who commanded the Petrel's section, I found he had orders to skirmish along the beach and stop sharpshooters who were annoying the Petrel, principally however, by nearly hitting two British gunboats which were lying near. We were cautioned by several foreigners whom we saw that the insurgents would fire at us from the houses if we went up town; but having received discretionary orders from Capt. Wilde, it seemed our duty to push on. The Boston's party was formed for street riot, and, following the usual custom in such cases, as senior officer present I confiscated the general's pony which one of my juniors was riding and rode at the head of the column. We conceived it to be our business to protect lives and property; to put out fires; to arrest looters; to chase out insurgents; and to cover the landing of the Army. This we did. The very first move was to detail a patrol for the warehouse district which had so far escaped the fire and to station a guard at the Hong Kong and Shanghai Bank against which three attempts had already been made We did what we could in saving property from burning houses, and we saved many cans of kerosene which had not yet become ignited as originally intended. By 12.30 we reached the custom-house and could get very little further as we were hemmed in either by fire or the river. We settled down to trying to save a large warehouse adjoining the custom-house, well knowing if it went up that the latter would be lost. It was filled with alcohol, wine and other inflammables, and while one section of our party was exchanging shots with some of the insurgents across the river, the rest of us were working in the warehouse, and also in trying to persuade a few fire-crazy ponies to leave their burning stalls. In the skirmish one of our men was shot in the foot but was further disabled by opening the surgeon's canteen while that officer was stooping over examining his injured member. He, however, added realism to the situation by being loaded on the gatling carriage in a limp condition. The Army began to appear on the scene a little before one P. M. and our career came to an end.

It appears that some time after our party had disappeared up the beach, Captain Wilde signaled General Miller "Why don't you bring your ships close up to the beach so you can land your troops?" The St. Paul with the Tennessee Volunteers on board had arrived the night before, and, when given permission to land, promptly put their ship close up to the beach and landed. The first troops ashore struck the beach at noon. They saw the Petrel's party returning to their ship and they supposed it was the entire naval force. It was not until three quarters of an hour later, when they arrived as far as they could go that they discovered that they had not taken the city.

General Miller and staff arrived a few moments later and, after some little delay in getting ponies to suit everybody, I was able to negotiate for the return of myself and party on board ship, having successfully covered the landing of the Army as is the part of the Navy in joint operations. I tried to emphasize the request that the guard at the bank should be regularly relieved, and that the work of saving the custom-house should go on; but a fire does not appeal to a soldier as it does to a bluejacket, and we returned on board taking the guard away from the bank. We reached the ship about 1.45 P. M., wishing we could have gone earlier and staid later.

A little afterwards, wishing to communicate with General Miller, Captain Wilde permitted me to take the steam-launch with a one-pounder and a gatling, and ten picked men, and with Paymaster Martin as a volunteer, we went up the Ilo Ilo river to the Jaro bridge, firing at various nests of insurgents on the left bank who were annoying the Army's sentries on the right. We hoisted the steam-launch's flag (having no other) on the governor's house, and placed a guard; saw General Miller; interviewed many business men in town; saw all of the foreign consuls; made a rough note of all the houses burned in the European quarter, and reached the ship about dark, passing at the entrance of the river the last of the total Army contingent of 2300 men being towed up to town to be landed, and noting that the fire near the custom-house had doomed that building.

I am convinced that it was most fortunate that the fight came off prematurely, and before they had time to arrange to burn the whole city. Had it commenced at sunset as planned there would doubtless have been much loss of life and a general conflagration. As it turned out, the entire native and Chinese quarters were destroyed, and the entire street of small shops was looted and burned. The British, German, and American consulates (our representative was British), a German apothecary shop, the large warehouse, the Club, the Custom-House, the Captain of the Port's office, and three or four private residences (all Swiss) were burned.

There is a nice point in international law involved in this destruction of foreign property in Ilo Ilo. General Rios knew the islands would be ceded to the United States by the Treaty of Peace and that an Army expedition was coming to Ilo Ilo. The transfer of sovereignty to us could only take place when we gained possession. Either the consuls should not have acquiesced in the evacuation and assumed any responsibility, or else Spain has not escaped the responsibility. The United States is certainly clear in the matter.

The Aftermath.

Within forty-eight hours after landing, the Army had spread out over the arc of a circle, including Jaro and Molo, and then settled down to an occupation of these lines waiting for reenforcements.

The Petrel carried the news to Manila of the taking of Ilo Ilo, and on February 14th it was known in Washington. General Miller's nomination as a Brigadier General in the Regular Army was sent in, and was confirmed on the following day, in recognition of the success of the expedition. As he retired at the age of sixty-four some six weeks later, the taking of Ilo Ilo was most opportune.

Immediately after the fall of Ilo Ilo Captain Wilde nominated Ensign Lay H. Everhart, U. S. Navy, as Captain of the Port of Ilo Ilo. That officer entered upon the discharge of his duties with such zeal and judgment that in a short time the commerce of the place was restored and the office thoroughly reorganized. The position of Captain of the Port, following the Spanish custom, is most important. This officer is charged with all matters relating to shipping, pilotage, clearances, discharging and loading ballast and cargoes, harbor-regulations, water-police, docks, public works, harbor-improvements, buoys and lights, immigration, admiralty cases, etc., and is second in importance to the *alcalde* of the port, being answerable directly to the governor of the province. Owing to the pressure for officers, Everhart was relieved from the duties on April 1st, but his services there will not soon be forgotten.

In connection with the opening up of the commerce of Ilo Ilo the writer spent two weeks in charge of the wreck-raising operations in the mouth of the river, which were successful. These little services of the Navy are mentioned here, since news filters very uncertainly from these parts, and the Navy's work in the interest of commerce should not be overlooked.

On the return of the Petrel from Manila, Captain Wilde detailed her to go to Cebu to try diplomacy with the natives there. She arrived February 20th and Commander Cornwell by his cleverness and judgment succeeded in peacefully occupying the fort and defenses on February 22nd, the natives contenting themselves with a formal written protest. Lieut. J. P. Parker, U. S. Navy, was appointed Collector of Customs. Lieutenant Plunket became Captain of the Port, and Commander Cornwell took over the office of Governor of the island. On hearing the news, as brought to Ilo Ilo by steamer, Captain Wilde sent a detachment of fifty bluejackets under Ensign De Witt Blamer from the Boston to assist in garrisoning the town.

Later all were relieved of their duties on shore by details from the Army from Manila, but the Petrel remained as guard-ship, and their relations with the people of Cebu were at all times most cordial and satisfactory.

A few days later the people of the island of Negros sent a delegation to Ilo Ilo and thence to Manila to negotiate, and shortly afterwards the Army took over the management of affairs there.

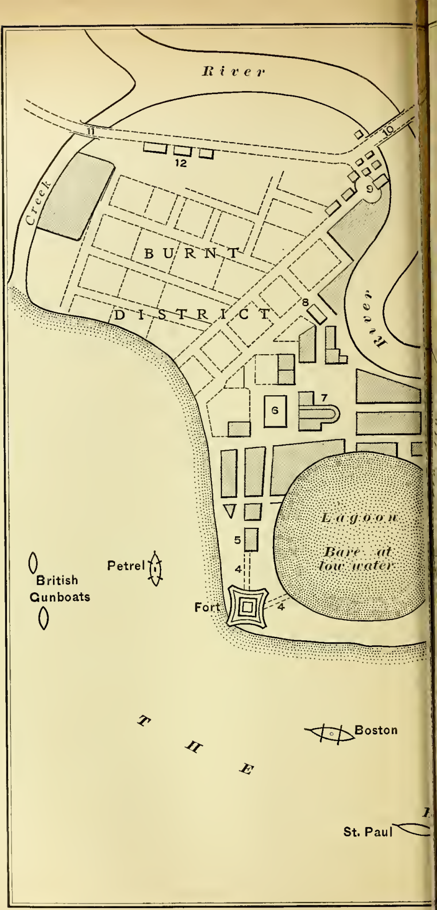
Personally it has been my good fortune since January 1st to cruise from the Sulus on the South to the North end of Luzon, and I have become impressed by the beauty of the islands and their undreamed-of possibilities. Manila is not the Philippines but every one seems to want the world to believe it. This is particularly true of a few Tagala sea-lawyers with a gift for writing clever proclamations and with diplomatic ability enough to throw dust in the eyes of the world. They are after the custom-house, and they want to run all the islands. They really represent themselves and a small following in the suburbs of Manila. Their troops are misguided and deceived by them. The Philippines are more than worth almost any sacrifice, although just now many look upon them as a white elephant. We have, however, fallen overboard and must learn to swim, and we don't need any one's help in the matter either. There is one thing, however, we must get rid of and that is our artificial, narrow, and senseless prejudice against the Chinese, who, of all the Asiatics, are individually the only trustworthy, commercially the only honest, and as employees the only faithful people who are at hand as the true instruments to use in making these islands a veritable treasure trove. To restrict them in any way will be a political blunder and commercial suicide.

A final word as to the taking of Ilo Ilo. In Army circles there is a feeling that the Navy took a rather unfair advantage of the Army in landing first. This cannot be easily dispelled.

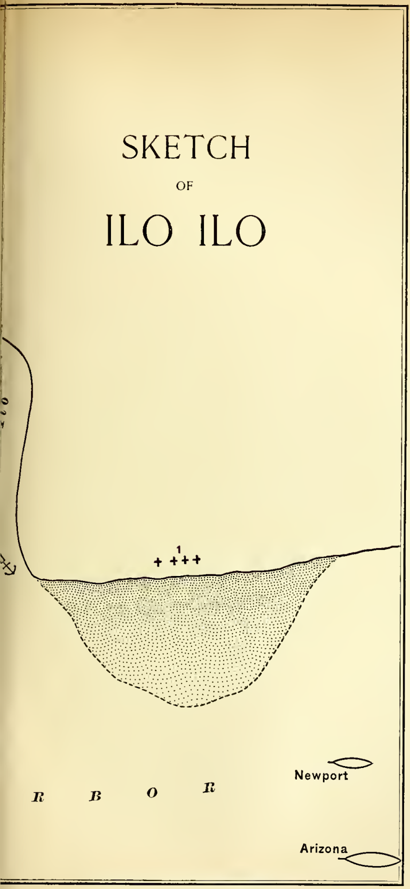
Any ship in the Navy can land its battalion on ten minutes notice. The knowledge that a landing party would be required at Ilo Ilo was not a secret. There was not a moment after 10.20 A. M. that should have been lost. Waiting half an hour as we did was sufficiently trying, and then to find that the Army was still doubtful as to the necessity and still hesitating, it was simply the plain duty of the Navy to land.

When the Army did land, the men were without the two days' cooked rations which are regarded as essential. It is difficult to feel sufficiently apologetic. The unfairness will always occur where one well organized body meets one not so well organized. It is all but impossible for the Army and Navy of the United States to cooperate; but the importance of their cooperation has never been brought home to the country by the national disaster thereby invited, and neither branch has ever had the licking each needs to make it try harder. Still it is less the Navy's fault than appears on the surface. The Army has charge of the seacoast fortifications, harbor defenses, and transport service, which are really naval duties. Congress gives us Army pay less 15 per cent. No wonder that in joint operations we are regarded simply as a convenient accessory. It only remains now for the Army to get a Navy of its own to dispense with us entirely. Judging by present Army ideas no previous training would be a necessary requisite to be an officer in their Navy, and this is not a mere pleasantry either.

The country has in the Navy and Marine Corps a harmonious, homogeneous, well organized, economically administered military service perfectly adapted to colonial purposes. In a lucid interval the country may see the economy and efficiency of such an arrangement and use it for what it is worth.



1. Masked Battery.
2. Wrecks in Mouth of River.
3. Light-House.
4. Trenches.
5. Stone Warehouse used as
6. The Plaza.



7. The Cathedral.
8. The Custom House.
9. The Governor's House.
10. The Bridge to Jaro.
11. The Bridge to Molo.
12. Barracks.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE HYGIENE OF THE NAVY RATION.

By Henry G. Beyer.

In recording some observations on the navy ration which the writer had an opportunity of making during last winter, he desires it to be understood at the outset that this paper is not intended to criticise adversely the present navy ration nor those who may be responsible for the same. Neither is it, on the other hand, the intention to look at things through the spectacles of that very engaging list of eatables which is passed around immediately, the moment the word "ration" is pronounced in certain quarters. We propose to look at the navy ration and its administration with unprejudiced eyes, armed only by a few simple but telling experiments. It does not require a great deal of experience to know that there is as yet a long way from a market or even a bill of fare to the inside of a man's stomach. If, therefore, it should suggest itself to the reader of this paper that certain steps on this way might put up with some very desirable improvements, let it be remembered that all such improvements have originated in criticisms prompted by the proper motives and rendered in the right spirit.

A ship's company is generally divided into a number of messes, each consisting of about twenty or more men, with their own cook and mess attendants. The quantity of stores served out to each mess by the paymaster of the ship varies, of course, with the exact number of men in a particular mess. There is on every ship a chief cook and several assistant cooks (?), attending, as well as they know how, to the preparation of the food; the mess attendants, or berth-deck cooks, having charge of the serving out of the food and, also, of the mess gear, its cleanliness, etc.

Long experience and observation having demonstrated the necessity for reorganization of this antiquated system of messing, a most laudable attempt was made quite recently to put into practical operation a "consolidated mess," one which is to include all the enlisted force on board ship with the exception of the chief petty officers.

Thus, the consolidated mess of the U. S. S. Indiana, as described by Lieut. B. C. Decker, U. S. Navy (Proceedings U. S. Naval Institute, No. 83, 1897), consisted of about three hundred and eighty men, a ship's cook of the first class, two cooks of the second class and four of the third class, a commissary yeoman, and a storeroom keeper. Without going into the details of its organization at the present moment, it will suggest itself to everyone having even but little experience with messing large bodies of men, that the proposition, made in this system of messing, to engage a higher quality of cooks and a better class of mess attendants than heretofore, is not the least important of its many good and admirable points. According to all accounts which we were able to gather, under the conditions of this consolidated system of messing the men live not only better, but also cheaper. We shall find later on in this paper that this very general and very favorable conclusion finds some very interesting and firm support in the results of our investigations into the comparative food-values as existing in our unmodified navy ration furnished by the paymaster of the ship as compared to those of a mixed or combined ration, that is, one made up of a part of ship's ration and a part of food bought in the market out of the money obtained from commuted rations. In short, we are in a position to prove that the food-value of our ration increases in direct proportions to the number of ship's rations that are commuted; and this fact we are inclined to consider one of the strongest and most direct arguments in favor of the consolidated system of messing.

In view of our figures as regards the food-values of the ration alone, the most impartial judge would declare in favor of the commutation of all ship's rations; he would have the regular ship's ration, in its pure and unmodified form, relegated to the function of an emergency or iron ration, to be used only whenever ships are kept at sea and have, from necessity, no communication with any of the markets on shore. The physical condition of the men under such a system could not do otherwise but greatly improve.

Upon one point, however, the greatest possible stress should be laid in any and every attempt at mess reorganization, namely, the quality of the cooks and mess attendants. The waste, owing to bad management from that source, is very large and most deplorable. The most hungry stomach will refuse to eat things, not so much because they are not eatable, but because they are neither cooked nor served in a manner sufficiently inviting. If one of the objects of cooking is to render the food more pleasing to the eye, more agreeable to the palate, improve its flavor as well as its digestibility, we see, in the first place, that three of the keenest of our special senses demand to be favorably influenced before this one of the special objects of cooking can be said to have been attained. Man may, from a chemico-physiological point of view, be compared to a machine, needing only certain quantities of fuel in order to do a certain amount of work; but he is, to say the least, a machine endowed with special senses and a will of its own. The social position of man in this respect makes, if at all, merely a difference in degree, not in kind. Cooking, furthermore, is to alter the texture of our food-stuffs so as to render them more easy of mastication and subsequent reduction to a fluid state in the stomach; that is, to render them more easy of a perfect digestion and assimilation. The average cook, therefore, besides having to be thoroughly drilled in the special methods of boiling, stewing, roasting, broiling, baking and frying the food, must be taught to pay some attention to the appearances of his products.

Fortunately, any man gifted with the average amount of sense can become a good cook or mess attendant and can easily satisfy all the above requirements, providing he is properly taught, trained, and intelligently and systematically supervised in his work.

The two following tables represent, in food-values, the rations served out to, and of the additional articles of food obtained by purchase and consumed by, a mess of twenty men during a period of fourteen days.

In order to obtain a greater variety of articles of food for their table than that which they receive in the form of rations, and in order to, furthermore, take advantage of the fresh fruits and vege-

TABLE I.

RATIONS SERVED OUT FOR FIFTEEN MEN IN FOURTEEN DAYS.

	Weight, kilos.	Proteids.	Fats.	Carbo-hydrates.
Fresh Beef	33.0	7.227	.297	.....
Canned Ham	11.5	2.760	4.197	.....
" Corned Beef	11.5	2.545	1.610	.....
Pork, fat	6.5	.942	2.424	.....
Salt Beef	33.0	7.227	.297	.....
Butter	1.3	.11	1.196	.....
Bread	57.0	7.752	.427	33.630
Flonr	9.0	.990	.180	6.408
Sugar	25.0	.35	.....	24.965
Beans	6.7	2.237	1.186	1.949
Potatoes	19.0	.380	.....	15.865
Canned Corn	2.0	.198	.92	1.368
" Peas	3.0	.660	.60	1.590
Turnips	7.7	.77	.15	.523
Cabbages	3.8	.190	.19	.296
Dried Fruit	1.3	.13	.....	.260
		33.244	11.990	86.834
Per man and per day	....	.158	.57	.442

Besides, the men received hardtack which was not eaten; they also received and consumed: 2.9 k. onions, 1 k. pickles, 3 k. coffee and 1.5 k. of tea.

Allow 15 per cent. for bones.

TABLE II.

ARTICLES OF FOOD, OBTAINED BY PURCHASE, IN FOURTEEN DAYS.

	Weight, kilos.	Proteids.	Fats.	Carbo-hydrates.
Beef	10.2	2.040	.357	.....
Ham	10.2	2.448	3.723	.....
Pork, fresh	6.0	.870	2.238	.....
Corned Beef	3.5	.815	.490	.....
Bacon	14.4	1.247	10.555	.....
Milk, condensed	6.7	.824	.737	3.272
Eggs, Nos. 288	14.4	1.944	1.670	.....
Liver	3.5	.700	.140	.....
Lard	5.7	.154	4.674	.....
Sugar	6.2	.35	.....	6.165
Bread	49.0	3.920	.735	24.098
Oatmeal	4.8	.604	.268	3.024
Rice	1.3	.91	.11	1.006
Beans	16.3	4.238	.326	8.802
Potatoes	86.4	1.728	.172	18.144
Tapioca	1.3	.10	.....	1.084
Macaroni	1.3	.117	.4	1.001
Hominy	1.0	.120	.20	.710
Codfish	1.3	.351	.5	.....
Peas, canned	7.2	1.584	.154	3.816
Tomatoes, canned	7.2	.....	.....	.....
Summary	....	22.244	23.179	67.312

tables which the market offers at different seasons of the year, the men on board ship prefer to have one-fourth of their regular ration commuted; that is, converted into money. With this amount of money thus obtained, and as much more as each man is willing and able to pay into the general mess-fund, the men, simply buy those articles in the open market whichever they prefer. The twenty men under consideration then draw fifteen (¾) rations; their food-value is represented in Table I. Table II shows the food-values of the articles obtained by purchase in the open market.

These twenty men obtain in ration-money for a period of fourteen days $14 \times \$1.50 = \$19$, and pay out of their own pocket an additional sum of \$23.75, making in all \$42.75. The cook, also a member of the mess, pays nothing into the fund, and, besides, draws the value of two rations for his services out of it, which amount equals for the fourteen days \$8.40, and which sum must, consequently, be deducted from the money spent for food, leaving a mess-fund of \$34.35. This brings the money value of the mess shares per man and per day down to 13 cents.

The following Table, III, is intended to show in a condensed form the relations which the different values bear to each other.

TABLE III.

	Proteids.	Fats.	Carbohydrates.
1. Food-values of articles obtained by purchase,	22.244	23.179	67.312
2. Minus 10% of intestinal waste, leaves.......	20.020	20.062	60.581
3. Food-values of articles received in ship's rations	33.244	11.990	86.834
4. Minus 10% of intestinal waste, which leaves	29.920	10.791	78.151
5. Combined values calculated per man and per day	.181	.110	.495
6. After subtracting ¾ value of *full* and *corrected* ration	.107	.38	.300
7. Leaves individual values obtained by purchase, at \$0.13	.74	.72	.195
8. As compared with food-value of full and corrected ration at \$0.30	.142	.51	.398

The first four items on Table III, being perfectly plain and simple, need no further explanation, but the other four, perhaps, need a word or two more. Item 5 represents the value in food-material received daily by each man under the combined system; that is, that quantity which he receives when he draws ¾ of his regular ration and buys the rest of what he eats. Item 6 represents the ration and share in the combined value of food-material consumed by him. Item 7 represents the share obtained by purchase. Item 8 gives the corrected sum in food-material which a man would receive daily at a cost of 30 cents, if he would live on his ship's ration alone. A man's daily expense for food, under the combined system, is 35½ cents, or 5½ cents more than the value of a ship's ration. If we now compare the food-value contained in the full ration at 30 cents per day, with the food-value of that part of the combined ration which the men obtain by purchase at 13 cents per day, we will find that the latter is quite a little less expensive than an equal share of the ship's ration would be.

If the men, namely, commuted all their ship's rations and bought food at the same ratio as above, they would obtain an amount of food the value of which would be equal to, proteids, 171; fats, 167, and carbohydrates, 450; or about one-fourth better than is the value of the ration for the same amount of money which the ration costs them, or 30 cents a day.

It is but fair to mention that, in this estimate, we have not included the hardtack which, though not eaten by the men, is furnished them in the regular ship's ration. Inasmuch as we wanted to get at the food-value of those substances which were actually consumed by our men, these, however, refusing to take the same, we were naturally obliged to leave it out of our calculation. But even if this was considered a part of what the men had received, it would scarcely invalidate the conclusions reached, since the proteid value and the fat value of the ration, which are the most expensive part of it, would thereby practically remain uninfluenced. When our ration is examined more closely it can easily be seen that it is rich enough in carbohydrates without the hardtack, and the instinct of the men simply made them refuse it, because there was no need of it.

So far, however, we must admit that our estimates are only approximately true, and a closer investigation becomes extremely desirable. Fortunately, the Germans have furnished us with a method of doing this.

For the purpose of having a more uniform standard for comparison as regards the difference in money-values existing between different diets or rations, and because of the fact that one part of proteid is not exactly equivalent to either one part of fat or carbohydrate, the Germans have created a "nutrient unit" for food-stuffs, based upon the market value of the different articles of food. In accordance with this standard of the price of food-stuffs:

1 part of carbohydrates has the value of 1 nutrient unit;
1 part of fat has the value of 3 nutrient units;
1 part of proteid has the value of 5 nutrient units.

From this it is easily seen that proteids are the most expensive, while carbohydrate are the least expensive of food-stuffs, and this is true the world over.

Let us now calculate the nutrient units of the several rations which we wish to compare according to this standard, and contrast the results with the money-values for which each may be obtained:

The number of nutrient units contained in the corrected ration to be obtained from the ships' stores per man and per day for 30 cents is 1261. The number of units which the men obtained for themselves at the rate of 13 cents per man and per day amounts to 781. For 30 cents, or the value in money of the regular ration, the men could have obtained an amount of food containing 1802 nutrient units, or about one-third more than they received for the same amount of money in the form of rations from the ship's stores. Expressed in a still more simple manner, one cent will only buy 42 nutrient units in the form of ship's rations, while the same cent would buy 61 nutrient units in the open market.

The question might be asked: Is our ship's ration, in the quantities that are furnished to the men, insufficient in nutritive value, and is this perhaps the reason why these men prefer to have part of it commuted, instead of living on the same exclusively? For although the extra expense connected with the combined system of messing is small, it is still large enough to deserve consideration, and, I am sure, no sailorman, extravagant though he may be in some respects, would incur it if he did not *feel* that it was a necessary expense and money well invested. In order to answer the above question satisfactorily, we will now have to consult some of the results of the investigations of physiologists with regard to this subject.

We find that, for the purpose of maintaining life in a perfectly normal state, we need certain definite quantities of proteids, fats and carbohydrates mixed in certain proportions. Any human being fed exclusively on a fatty diet must finally perish from the want of nitrogenous food. In the same manner an individual fed exclusively on carbohydrates will inevitably incur the same risk.

After much experimentation and the most painstaking and laborious investigations on the part of both hygienists and physiologists, it is estimated by Voit that a laboring man, working from 9 to 10 hours a day and weighing on an average from 70 to 75 kilos, requires 118 grams of proteids, 56 grams of fat and 500 grams of carbohydrates.

The regular ship's ration, exclusive of hardtack, pickles, coffee and tea, gives us a nutritive value corresponding to 142 grams of proteids, 51 grams of fats and 398 grams of carbohydrates, a nutritive value which makes the ration superior as regards proteids, equal in fat-material and also superior in carbohydrates, providing we include the hardtack in the diet, as compared with the diet demanded by Voit for the laboring man of an average weight of 70 to 75 kilos. This estimate of Voit is the most accurate one attainable, and stands in almost perfect agreement with the estimates of all those authorities in scientific physiology and hygiene who have given this subject the most careful attention, excepting perhaps, minor differences as regards fats and carbohydrates.

It is considered that an allowance of 118 grams of proteids is a most generous quantity and that a man—our average man, for instance—can exist on considerably less than that amount. But we find on comparison that the nutritive value of our ration is equal to 142 grams in proteid material, or 24 grams more than is asked in the above generous allowance made by Voit.

The average man of Voit is one weighing from 70 to 75 kilos. Consulting our table of weights, we shall find that our average man only weighs, in round numbers, 65 kilos, or from 5 to 10 kilos less. It is perfectly well known that both the amount of mechanical work performed by a man, and, the amount of heat produced by him, stand in a certain definite relation to the weight of that man, and, consequently, also the amount of food which he consumes. *Caeteris paribus,* we may assume that our average man of 65 kilos needs less food than Voit's average man of 75 kilos. All the men on whom these observations were made belong to a gunnery class, undergoing instruction in the construction and usages of modern guns, which is, as the men have frequently confessed themselves, light work when compared with that which they would have to do in the average cruising ships, or with that which a laborer performs who is steadily at work for 9 to 10 hours a day. Consequently, our navy ration ought to be not only perfectly sufficient in its food-material, both quantitatively and qualitatively, but must be considered a generous allowance. And this fact also is freely admitted by the men themselves. The answer to my questions in this regard which I most frequently receive from the men is: It is enough, *but* . . . and there follows a pause.

Thus, in spite of this generous sufficiency as regards the quantity and quality of our navy ration, we must still admit the existence of a number of good and sufficient reasons on the part of the men for wishing to commute part of their rations.

Referring to Table III, item 5, we shall observe that under the combined system of messing, the daily food-supply per man is, on the average, equal to 181 grams in proteids, 110 grams in fats, and 495 grams in carbohydrates. This result of our calculation has been attained after making due allowance for all possible loss which might be incurred in the handling of the raw material of the different food-stuffs, and also after deducting the weight in bones and other waste from them. But allowing for the sake of argument, if for nothing else, even an additional loss of, say, 30 per cent., owing either to ignorance of cooks or to habits of wastefulness, we should still have left a diet consisting of 127 grams of proteids, 54 grams of fats, and 347 grams of carbohydrates; a diet more than equal in its proportionate nutritive value for our man of an average weight of 65 kilos and doing light work to that required by Voit for a man of 75 kilos in weight and working steadily for from 9 to 10 hours a day.

The most obvious conclusions that we can come to from the above method of reasoning are that the men do not get what they buy, or, if they get it, they receive it in such a form that they either cannot eat it, or, if they eat it, do not assimilate it. For if these men really got what they bought and properly assimilated it—converted it into flesh and blood—we should necessarily be led to expect a corresponding increase in their average weight, considering that their work was light and the demand for energy small.

Looking at the table of weights of the forty-two men, in which number our twenty men are included and all of which belong to the same gunnery class, practically all living under the same identical conditions and circumstances, we find, during the four months when their weight was taken at stated intervals, that they have made but an average increase of 0.4 kilos or not quite a pound. We can, therefore, only say that these men have merely held their own for a period of four months, and that in spite of their living during all this time as regular and orderly a life as men can live, and under the most favorable conditions not only of work but also as regards environment and climate.

The above-mentioned conclusions will find still greater support when the following calculations will have been considered:

It is well known that food-stuffs, when burned, develop different quantities of heat. Thus, the greatest amount of heat is developed by the fats, while the proteids and the carbohydrates are about equal in this respect. It is generally accepted as a well-established law in physiology, that the calorimetric values of the different articles of food determine also their respective physiological values as nutritive substances of the body.

Thus, one gram of fat produces 9.3, one gram of proteid and one gram of carbohydrate each 4.1 large calories. Whenever fats and carbohydrates are burned or oxidized within the body their calorimetric values are absolutely equal to their physiological values, because both of these substances are completely oxidized to form water and carbon dioxide. The physiological value of the proteids, on the other hand, remains behind the calorimetric value because proteids are not completely burned within the body; the remnant being urea. It has been estimated that the physiological value of the proteids is only from 72 to 78 per cent of their calorimetric value. Practically, one-third of the calorimetric value of proteids is deducted in the calculations for their physiological value in order to cover the loss both in urea and the small portion of nitrogenous substances lost in the fæces. According to Rubner, 100 grams of fat are isodynamic with 225 grams of proteids or 240 grams of carbohydrates respectively.

According to these figures, the amount of energy conveyed to our bodies in the form of food, providing the quantities ingested are known, becomes a matter of easy calculation. This energy may, furthermore, be expressed either in terms of heat-units or calories or in terms of mechanical work, since one *large* calory, or that amount of heat which is necessary to raise the temperature of one liter of water by one degree of C.°, corresponds to 425 units of mechanical work; in other words, that amount of energy which is sufficient to raise 425 grams in weight to the height of one meter.

The food-stuffs with which we nourish our bodies must, then, first of all, supply the demands for the amounts of energy made upon us. A fully grown adult individual uses up, according to his occupation or the amount of work which he performs, from 2400 to 3000 large calories during twenty-four hours. Consequently, his diet must consist in food-material possessing *at least* a calorimetric value equal to that amount. More, of course, would be required by a growing body or by one under any great physical exertion.

The calorimetric value of the ration required by Voit for his average man, weighing from 70 to 75 kilos and working from 9 to 10 hours daily, equals 3055 calories. The corrected navy ration (item 8, Table III) amounts to 2696 calories. The combined ration (item 5, Table III) on which our twenty men have presumably subsisted, comes up to 3805 calories. The combined ration, less 30 per cent, which they probably subsisted on, in reality, gives us 2664 calories; and these estimates seem to agree with the actually observed facts as closely as could possibly be expected.*

* It is not an easy task to determine, in a more direct manner, the work done by a man in 24 hours. This is, however, comparatively speaking, easy in the case of a man's walking or marching. In walking it is equal to 0.07 k. p, where k is the body-weight, p the number of steps taken, providing the walk was taken on a horizontal path. While marching, of course, the weight of the accouterments is to be added on to the body-weight; and, if any heights are climbed, these also must be added on to the results of the calculation.

TABLE IV.—WEIGHTS.

Name.	Age. Yrs.Mos.	Date of Examination. Nov. 23.	Dec. 11.	Jan. 11.	Feb. 25.	Gain.	Loss.
Nolan, M. J......	24, 7	62.7	61.3	64.1	64.1	1.4	....
Kohler, F. J.....	29, 4	67.3	67.5	67.7	66.8	....	0.5
Damon, E. J.....	25, 8	67.7	67.0	67.0	67.0	....	0.7
Danielson, C.....	25, 5	62.7	62.3	64.1	64.1	1.4	....
Wolf, W. F......	25, 1	63.6	62.3	63.2	64.5	0.9	....
Stickney, F. G...	30, 2	62.7	65.2	65.0	65.0	2.3	....
Harmer, W. P. ..	24, 8	58.6	60.6	61.3	62.2	3.6	....
Clark, B. H......	25, 11	62.7	62.7	62.2	61.3	....	1.4
McMullen, E. B..	23, 11	59.3	59.2	62.3	61.8	2.5	....
Fox, R. W.......	23, 10	68.0	69.1	67.0	70.0	2.0	....
Johnson, C......	33, 8	75.2	72.7	73.2	72.3	....	2.9
Frederickson, F..	32, 4	59.5	60.2	60.2	60.9	1.4	....
McCrea, F.......	28, 1	65.0	64.5	66.4	65.9	0.9	....
Ryan, D.........	26, 7	62.3	63.2	63.2	64.1	1.8	....
Sherwin, E......	20, 10	69.7	71.3	71.3	74.1	4.4	....
Wade, C.........	26, 0	53.4	52.3	53.6	52.7	....	0.7
McQuade, F.....	30, 4	61.1	63.2	63.6	59.1	....	2.0
Smith, B........	24, 1	53.0	53.0	53.0	53.2	0.2	....
Shepley, B. H....	23, 0	55.4	55.4	56.8	55.9	0.5	....
Hansen, H.......	29, 11	71.8	71.8	73.4	71.8	....	....
Heyden, J.......	26, 2	69.1	69.5	71.8	69.0	....	0.1
Brownlee, W. J..	25, 8	65.4	66.8	66.8	65.4	....	....
Hurdle, O. F.....	23, 3	68.0	67.0	67.0	68.2	0.2	....
Pollard, G. A....	26, 2	69.1	69.1	69.8	67.3	....	1.8
Hicks, C. T......	38, 6	67.3	69.8	71.0	70.0	2.7	....
Doulon, P.......	32, 11	68.2	70.0	69.5	68.6	0.4	....
Creelman, N. J...	23, 3	59.5	59.1	60.4	59.0	....	0.5
McNally, F. J....	26, 8	64.0	63.4	62.5	63.6	....	0.4
McQuay, S. C....	28, 10	61.6	59.5	60.4	61.3	....	0.3
Svenson, A. J....	23, 1	62.3	61.8	62.7	63.6	1.3	....
Crone, C........	24, 7	58.0	55.0	58.0	55.0	....	3.0
Herbert, P.......	28, 0	66.0	66.6	67.5	66.0	....	....
Linden, K. F.....	30, 1	63.6	63.2	64.8	64.1	0.5	....
Bottcher, R. D...	23, 6	63.6	62.0	64.5	64.1	0.5	....
Jacobus, F. W...	23, 2	67.5	66.1	66.8	67.0	....	0.5
Mills, R. H......	27, 1	67.5	70.0	71.8	68.1	0.6	....
Kraczewski, B...	32, 2	80.6	78.2	81.1	79.0	....	1.6
Brewster, C.....	29, 11	64.5	65.9	67.3	66.8	2.3	....
Pederson, C. V...	25, 7	65.0	65.0	65.0	64.1	....	0.9
Kennedy, J. M...	23, 9	57.3	59.1	60.4	60.4	3.1	....
Lemieux, S......	32, 3	60.0	59.1	59.1	56.8	....	3.2
Morey, A. L.....	23, 2	54.1	54.1	56.8	57.3	3.2	....
Average	27, 5	64.0	63.9	64.8	64.4	0.9	0.5

In other words, the demand on the men's energy amounted on an average to 2664 calories, and they took just sufficient food to supply this demand, and the rest, if there was any, was wasted for reasons of poor cooking and of serving the food in an uninviting manner.

To summarize, the following conclusions seem to be justified by the above investigations, namely:

1. Consolidate the number of small messes on board ship into one general mess.

2. Train your cooks in the art of good and economic cooking and supervise their work on board ship.

3. Commute all ships' rations whenever communication with the markets on shore can be established, as recommended in the "consolidated mess system."

4. Relegate the present ships' ration to the function of an emergency or "iron ration," to be used only in cases of necessity, or whenever communication with the markets on shore is out of the question for good and sufficient reasons.

5. Authorize a war ration.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A SCHEME FOR A FRENCH NAVAL WAR COLLEGE,

With a Report

By Count de Treveneuc, Committee of Naval Affairs.

Admission to the War College is to be by competitive examination, open to lieutenants of the senior grade only; examination to be held by a board of naval officers. The course to be two years; the first year studying at Toulon, the second in a special practice squadron. At the end of the first year the officers that merit the second year's course go to sea in the practise-ships. The remainder, if they have passed their examinations, get first choice on all commands not specially reserved to the officers that successfully complete the entire course. The privileges extended to the officers completing the full course are: (1) first in selection for duty on staff of flag-officers, ashore or afloat; (2) at least one-third of the commands shall be reserved for them.

The officers granting these diplomas to consist of the inspector-general, the commandant of the school, the commander-in-chief of the home station, and two officers specially detailed.

Many excellent criticisms upon the needs of the service are brought out, which are equally applicable to our own, and well worthy of consideration, especially in the matter of a construction policy.—The Editor.

Those of you who, desirous of having your personal opinions on maritime questions corroborated by professional men, have addressed yourselves to naval officers, have all, doubtless, been equally impressed with the diversity of replies made to each of the questions submitted.

Even when conferring with the most eminent persons, inquiries having been limited to a request for a general opinion on the naval warfare of the future, the replies received have been, most frequently, but uncertain—sometimes contradictory—affirmations.

It may be even that the decidedly alarming admission was made that a definite opinion on this question did not exist; that it could not exist, because of the lack of sufficient data; that the naval war of the future would produce entirely novel military situations; and that neither its strategy nor its tactics could be foretold.

And, furthermore, to confirm these contradictions and negations, it is only necessary to examine professional publications of the highest standing or to read over the records of parliamentary discussions and to note the statements of the various ministers who succeed each other—alas, too frequently!—at the head of our two military departments.

Yet, at the same time, it is unity of ideas—the adoption of fixed principles—which will appear as the chief and decisive factor of success in modern warfare, at sea as well as on land.

In fact, gentlemen, modern warfare has definitely assumed, for an armed nation, an entirely new and peculiar aspect.

The long and methodical armed encounters of the 18th century were followed by the irresistible and crushing blows of the Napoleonic campaigns. The Emperor expressed in two words the secret of his astounding achievements: "Masses and Movement."

Since that time, the masses and their movement have been increased nearly tenfold.

On land, this is the instantaneous mobilization of an entire nation, the rapid organization of bodies hitherto not existing and the concentration of all the forces for the purpose of striking a decisive blow and to prevent the adversary from taking the offensive.

At sea, this means blows even quicker and more crushing; this is the mobilization, within the very hour, of the organized forces, promptly followed by that of all other available material.

This gigantic effort will be required immediately upon the assembling of elements which, for the greater part, have hitherto been, to a certain degree, strangers to one another. The leaders will not know their subordinates; many will occupy a position, on the very morning of the battle, with which they were unfamiliar the day before; yet, the victory depends upon the immediate concentration of all the forces. The commander-in-chief's purpose must be understood, nay, even anticipated by all officers, of whatever grade they may be, without a preliminary understanding or instructions given at the eleventh hour.

The time is no longer when one could expect the victory in battle to rest upon a single brilliant stroke of genius. The war of the future must be prepared long beforehand and the details of its material thoroughly tested. The brilliant inspiration of the last moment must be supported by the weight of common opinion. The patient and methodical labor of Germany, adjusting piece by piece and regulating during a half century all the parts of the formidable machinery which crushed us, furnishes a striking example which should suffice us.

With the advent of modern warfare, the old saying, "The art of war is only learned in war," has lost its value. No, the war of yesterday is no longer the school of the war of to-morrow—that school must be found in the armed peace of to-day. No, the day no longer exists when a Duquesne, a Tourville or a Suffren could, during interminable cruises, inure his crews, instruct his subordinates and instruct himself, paving the way by brilliant feats of arms for victories even more astounding. The blows to be struck in the wars to come must be decisive. Those who are to strike them should long before be prepared for their several duties.

And then, the theaters of operations are enlarged and extended; the means for carrying on war are multiplied and infinitely varied.

The commander-in-chief can no longer personally superintend the regulation of details as opportunity offers. Every one must be at his post, ready to carry out his part at a mere signal of execution.

Hence, the *raison d'être* for a settled policy appears in still another form—perhaps its highest—that of the *initiative*.

Is it rash to imagine one of those great encounters at sea, where the elements of warfare, of the most diversified types—ships of all classes, fortifications, submarine defenses, fixed or mobile—are assembled for a supreme effort, opposed to each other at the same instant, on the same field of battle, and finally, for numerous reasons, failing of concerted action under the direction of a single mind?

And yet, what other bond between them can we imagine but a common purpose, known to all, understood by all, and carried out by all in the same manner?

If all these considerations, gentlemen, of a nature concerning purely morale and method in military affairs, are applicable as well to the details of land as to those of naval warfare, there appears in the consideration of the latter yet another element which emphasizes with particular force the need of an established policy. I speak of the importance of a *materiel* which will be of great importance in the future and which weighs heavily on the finances of the country.

Is it not obvious that the *materiel* of the navy should be governed by our conception of the strategy of the war in which the same is to be used—that it is rather the means which should be regulated by the end to be attained than the end by the means—that it is folly to begin the construction of vessels, each of which represents millions of accumulated capital, if it is not known beforehand for what purpose and in what manner they are to be employed?

In a word, it would seem that it is not the *materiel* which should regulate the character of the warfare to be waged, but that the character of the warfare should regulate the design of the *materiel* to be constructed. From which it follows, as principal corollary, that the constructor should not fix the design of the vessel for the (sea-going) officer, but that, more properly, the latter should require of the constructor a certain type of ship, furnishing him with the data of the problem to be solved—the conditions which the ship is to fulfill.

It has often been repeated that the strength of a nation's fleet should be in accordance with its foreign policy. This idea is more completely expressed by saying also that a country should have a fleet in accordance with its strategic conceptions.

Strategy is intimately connected with policy, of which it is the active agent.

One of our honorable colleagues, M. Lockroy, has expressed this idea very forcibly in his work on our navy.

Speaking of the diversity of types produced at our dockyards, he says: "It is probably the search after the best which has brought our constructors to this fatal variety of type; but it would seem that imagination, fancy only, has governed these designs as a whole—one searches in vain for a recognized plan, a governing idea—something tending to show that there has been kept in mind a certain objective, that certain eventualities have been foreseen, that in a certain way, the manifold problems of war have been understood and solved."

Alas! the confusion of types proves forcibly the confusion of ideas; the former is a striking manifestation of the latter. And whence could light be shed upon this chaos, since all our maritime institutions still lack a center of intellectual activity?

Let us follow, step by step, the normal career of our naval officers and let us analyze its successive stages. To begin with, an elementary education frightfully hurried and overdone, the rapid assimilation of a most complex course of study, the intellectual driving which the limit of age for entrance into the naval school at Brest makes practically inevitable. Next, two years of assiduous study in the limited field on board the Borde. Then, as a valuable correction and fully necessary, a practise-cruise which comes as a blessed relief to young brains too long overcharged. From time to time, regular and frequently recurring examinations with all their nervous strain. Later comes the reaction: the scattering to the four winds of the old text-books and their contents, the joy of forgetting after having learned too much. At this time, there begins for the young naval officer the experience of life and of the daily practice of his profession, infinitely absorbing, irresistibly attractive. Each of the details of this delightful career is, so to speak, an entity capable of occupying the entire active period of a man's life.

One looks at them, necessarily, as through a microscope; and one following upon the other, each inevitably absorbs, to its own benefit, the faculties of the most robust.

Cruises alternate with periods of other duty, and the years pass by. The long monotony of the grade of lieutenant is interrupted, for some officers, by the pursuit of some specialty. There, also, a detail predominates—the small-arm, the gun, or the torpedo—which absorbs all the officer's energy to its own profit. Some are attracted by scientific studies and occupy their time thus. In time, the officer attains to command. The command is the ambition of every seaman who is worthy of his profession. And how enthusiastic, indeed, are these commanders, whoever they may be, however modest they may be; what a satisfaction, this uniting in the same hands, at the age when physical activity wanes, of authority and responsibility! But also, how absorbing —nay, hypnotizing! And yet, each of these commanders, though he be the commander of the most powerful single vessel, is but an item in the whole organization of warfare.

Again details absorb all the vital force, to the detriment of the whole. And each individual, feeling the presence of a superior in rank, who is immediately responsible therefor, considers that the whole does not concern him, takes no interest in it, and leaves it to him who is officially responsible. And thus we pass on from grade to grade, from one period to another; we pass from the torpedo-boat to the armor-clad, to the division and the squadron, always on the search for a period in the life of an officer when the whole may be taken up and studied, but this period is never found. This is of supreme importance to the national defense; it is this, gentlemen, which your committee has attempted to definitely provide for in the bill which it has the honor to submit for your consideration.

The object of this bill is to supply the Navy Department with a school for study of the higher branches of the art of war, analogous, in principle at least, to that higher military school which, in uniting the army on one definitely fixed policy, has already achieved such remarkable results. Since the opening of this session, the committee, impressed with the importance of the question, has delegated a subcommittee to study the most practicable way in which this school can be established and what should be its functions in order that it may accomplish all that may reasonably be expected of it.

The subcommittee had already drawn up its conclusions when, upon the appointment to the portfolio of the marine, of our colleague, the Hon. M. Lockroy, our proposals were realized, essentially at least, by a decree.

M. Lockroy was pleased to appear before the subcommittee and explain to them the origin of the decree by which the school was established, and in accordance with the provisions of which it was to exist during the fiscal year 1895-1896.

The discussions which then occurred have since been reproduced in his book "La Marine de guerre." They are, furthermore, summed up in the decree signed by him.

The working of the school, as it had been established by the decree of December 27, 1895, fulfilled, to a great degree, the general requirements of the committee's plan. The subcommittee witheld the statement of its opinions, considering it advisable to await the results of the enterprise which had been undertaken. These results were very remarkable, according to the report of the inspector-general, whose duty it was to give an opinion on them. In the meantime, there was a change in the Ministry of Marine and, on the 13th of October, 1896, the new incumbent, Admiral Besnard, issued a decree which effected throughout radical changes in the organization previously established.

True, the idea still existed of a superior school, but its execution was on altogether different lines. An entirely new institution was created. This is in existence at the present time, and it would seem, should also give most interesting results, though of an entirely different nature from those of its predecessor.

The vicissitudes through which the "Ecole superieure de marine" passed shortly after its establishment have impelled your committee to hasten its labors and to establish its conceptions by means of legislation. It would appear to be necessary that its existence be placed under the safe-keeping of the law.

The object of the school is twofold: it is, primarily, to propagate a common doctrine among our naval officers. This, we have attempted to show, is an imperative necessity, indisputable —imposed by modern warfare—it is the condition upon which depends the future existence or extinction of our military power both on sea and on land. The doctrine should originate in high places. Its creation should devolve upon those in supreme command: it is for the school to diffuse it. At the same time, the doctrine of defining it and of putting it to practical test, in order to verify its propositions. It is, *par excellence,* a *technical section* of tactics and strategy, always at the disposition of the chief of the general staff, under whose authority a subsequent article will place it.

Its second object—and this is not at all its least important duty—is to create commanders for our navy, to educate for it general officers. We use here the expression "general" in its absolute sense.

An officer invested with command should be a general officer in the etymological meaning of the word. He should rise above the consideration of all details, in order to grasp them as a whole; he should be familiar with the working of the various departments, those which he personally directs, as well as those which come more or less directly under his general supervision. It is in his hands that all the essential elements of warfare should be combined.

Without these elements, all is inutility, superfluity, waste of effort, time and money. In any case, the commander-in-chief should not be under the influence of subordinates—for him to command, for them to obey.

Orders given should be capable of execution; to this end, it is necessary that he from whom they emanate should understand the requirements, the means of action, and the precise limits of execution of those to whom they are addressed. The efficiency of the command is a function of this synthesis, from which springs harmony of action. Failing this, there is a dispersion of effort, incoherence, and impotence.

In time of peace, as in time of war, the commander should be capable of exercising command before he is actually invested with it. The grave responsibility of exercising command forbids its use as a means of educating the officer entrusted with it.

The prestige of the commander must be preserved. "Active" discipline, according to Dragomiroff the only useful one, can be inspired only by the confidence which the subordinate has in the ability of his chief.

The "Superior school of the Navy" should be the nursery for high command.

Shall admission to the school be based upon a competition, or upon the opinions of a board of classification which is to decide according to the previous record of the officer? An almost unanimous decision was arrived at in favor of the principle of competition.

Competition has seemed to us to be the only perfect method—at any rate, as nearly perfect as possible—of assuring impartiality. Your Committee has judged it to be absolutely necessary to dispel the mere semblance of favoritism, to reduce to a minimum the chances of an incorrect decision in a matter which may have a deciding influence on the futures of the officers of our ships. We are of the opinion that any kind of military career already offers, of itself, so many doors necessarily open to outside influences that, at an important point in this career, the lawmakers should seek to insure a rigorously impartial trial.

It has, furthermore, appeared to us that a competition for admission would be a singularly powerful incentive to study during all the earlier years of the naval officer's career.

Upon graduating from the school at Brest, all our young cadets well know that, at a date which they can anticipate, they will be obliged to show what they have accomplished, and that their future career will, in a large measure, depend upon this test.

After having learned how to work, they will apply themselves resolutely to the task at the age when study comes the easiest and gives the best results, but is, at the same time, the least in favor.

After several years of these individual efforts, which alone can develop the resources of the mind, each generation will contribute the result of the combined efforts of its individual members to a great intellectual center, from which will emanate that unity of doctrine, without which all is wasted in modern warfare.

Having once established the competition, it became necessary to place it at that point in an officer's career when it would produce its maximum beneficial effect.

It was important that certain conditions should be clearly defined, so that there should be provided for, at the same time, a maturity of intellect in the candidates and an intellectual suppleness which would still enable them to grapple, at times, with difficult problems.

It was also of prime importance that each officer should have given evidence, before his entrance into the "Superior School," of his total value from a military standpoint—as much from the point of view of the practise of his profession as from the point of view of his aptitude for command.

There are still other considerations in fixing the limit of age. In fine, it is essential that the date of graduation from the School should be sufficiently near the date of promotion to the higher grade, that the intellectual benefits should bear fruit at this time and that the ideas acquired shall not have become obsolete. At the same time, these doctrines should be disseminated among those of the middle of the list—among minds young enough to be malleable—of the grade of lieutenant.

All of these various, and at times, conflicting conditions appear to us to be satisfied, as nearly as possible, by selecting senior lieutenants.

Several members of the committee considered that the possession of a certificate in some specialty should be inserted as one of the conditions of the competition. The majority, however, disagreed, considering that the good which results therefrom would, in many cases, fail to compensate for the practical difficulties inherent in the forced introduction into the officer's career of another year of study. It is, above all things, important not to keep our young officers from those distant cruises, the hard practical experiences of which are unquestionably one of the best tests of the physical and moral vigor of our seamen. Nevertheless, certain advantages might, very properly, be given to those candidates having certificates at the time of the competition for admission.

The Committee has taken under consideration the form to be given to this competition. This, without doubt, is a delicate question.

The Subcommittee endeavored to accomplish this by fixing specifically the nature of the tests.

The Committee considered the latter to be an encroachment upon the executive authority and has left the matter to be regulated by ministerial decrees.

But it has always been of the unanimous opinion that the professional qualifications of officers should be taken into consideration. It has caused to be inserted in the proposed legislation the provision that a mark of general aptitude, based upon his previous service, be assigned to each candidate by the Board of Classification.

The examinations for admission should be largely open; every officer, whatever may be the fortune of his seafaring life, should, at several times during his career, have an opportunity to take part in the competition. Every precaution will be taken to insure the fairness of the tests.

The subjects for compositions, selected under the direction of the Chief of the General Staff, are to be sent, sealed, to the various places where examinations are held, the results being afterwards collected by a special board charged with the duty of considering them—in absolute ignorance of the names of the authors.

The length of the course has been fixed at two years. It has appeared to us, in the light of experience acquired, that one year has been clearly shown to be insufficient to satisfy the conditions imposed. Furthermore, the division of the course into two parts, one devoted to historical study and the other to practical applications thereof, imperatively demanded a two years' course, under pain of intellectual overcrowding and incomplete assimilation.

This division of the program is the capital and characteristic feature of the bill which is submitted to you; it is this which, in a measure, distinguishes the Committee's conception of the subject from the various ideas which have been tried.

The decree of December 27, 1895, established the school on board of three cruisers. Officers were on board ship during the entire course. These conditions were necessitated by the short space of time at disposal.

The decree of 1896, on the other hand, followed an entirely different view; the school was established on shore, at Paris, thus devoting the greater part of the course to theoretical study. The practical exercises were, consequently, limited to two months at sea in squadron, during which time the student-officers, scattered among the various ships of the fleet, took part in maneuvers which were, no doubt, very interesting, but which might frequently bear no relation whatever to the theoretical principles taught at the school.

We beg leave to disagree at this point, in order to refute, from now on, a theory which is in vogue and which seems to us dangerous—the theory which sets it forth as a principle that the fleet is the only proper school of tactics for the navy.

The fleet is not a school, but a fighting force of the first rank, where each person is at his battle-station, his mind absorbed by the heavy weight of his personal responsibility and the multifarious details of the duty with which he is charged.

The fleet is no more a school than the sixth corps in the Vosges or the second division of cavalry at Limeville. Instruction is carried on there, to be sure, and professional knowledge increased, because at each step in the ladder of rank and command, the senior is the natural instructor of those who are under his immediate command; but this is done only according to strictly, one might say officially, defined lines, and beyond which it would be hazardous to authorize experiments, however instructive these might otherwise be.

On each ship, the divisional officer is at his guns, the torpedo-officer at his torpedoes; and as we have stated in our general survey of the subject, it is attention to these details which, except when he is on watch, make up the officer's duty. It will be urged, no doubt, that officers should be informed of the scheme and purpose of each maneuver and that, upon the completion of the same, these officers should all be assembled by the admiral, for the purpose of a general *critique*. Undoubtedly this is desirable; but how difficult this will be to accomplish in practise! And furthermore, would it not show a poor knowledge of human nature to fail to take into account the lack of interest of all persons in that which does not immediately concern themselves? At the most, the fleet is a school where the commander-in-chief and his personal staff may gain instruction; besides, it would be dangerous to carry such a doctrine too far. In any case, the fleet cannot be a school for younger officers.

To return to our subject after this digression—a little lengthy, perhaps, but which has seemed to us to be necessary—we will state that the author of the decree of 1895, as well as the one of the decree of 1896, has appeared to us to have permitted himself to be governed by financial consideration, to which your Committee has not considered it necessary to pay attention in the establishment of an institution which it considers indispensable to our national defense. Besides, the expense will not be great.

We have found ourselves unanimously agreed, as we have said before, on the necessity of making the "Superior School of the Navy" a school of advanced military studies. Its object should be to take officers accustomed to the daily practice of their profession, in order to make of them experts in the art of war in the fullest sense of the word. Its immediate purpose is first to develop competent staff-officers; to surround the commander-in-chief by an atmosphere of intellectuality, in which he will feel at ease, undisturbed by minor cares, and sure of being understood and ably seconded.

This, of itself, will create a place especially adapted where, perhaps, the leaders of the future will be developed.

And so, believing that such a result could only be obtained at the price of considerable intellectual effort, we have deemed it important, above all, to give the officers the best material facilities for work. Now, there is no doubt that the life on board ship fails to satisfy these requirements.

We considered it essential that a portion of the work of the course should be purely mental. At the same time, your Committee concluded that, after a sojourn on shore devoted entirely to theoretical study, the practical application of the theories taught, the verification of the conclusions arrived at, would become a necessary complement of the instruction of the school.

It is with this end in view that the second year of the course has been set apart for a period of application on board of armed vessels, organized in a division of instruction, and forming the natural sequel to the course of study of the first year.

We have already shown that a fleet could not, in any case, be a school, not even a school of application. This character could only be developed in a naval force especially set apart for this purpose. That, however, would not prevent it, as we shall see by what follows, from drawing lessons from certain maneuvers of the entire squadron which could not be carried out by a single division.

The period on shore is, in effect, based upon the necessity for the dissemination of a common doctrine. This applies, in principle, to all officers of normal value, it is to be desired that all officers may profit thereby and should it become necessary to debar a large number therefrom, it would be because the exigencies of the service interfered to limit the number of admissions. We hope, nevertheless, that the number of those selected to benefit by the instruction given during the first year will be considerable.

The period of application, on the contrary, which is to be the real school of command, should be reserved for a carefully selected few. The selection of these officers will be made during the first year's course, and is to be the result of numerous and almost constant tests.

The competition resulting from this method will possess a character of absolute fairness; it will give, unquestionably, the exact value of the officer and will not rest upon the sometimes doubtful criterion of a single examination.

During the past few years, our naval institutions have often been severely criticised; there has been talk of reforms to be effected throughout. No one denies any longer the advisability of modifying in certain respects the present organization which perhaps fails to meet, in every way, the requirements of a new situation. But before thinking of reform, we believe it to be, first of all, necessary to supply that which is lacking and which it would be supremely imprudent to dispense with any longer.

Our navy possesses incomparable elements of strength. Recruiting our crews from among our splendid maritime population, we are assured inexhaustible resources with which no other nation can think of competing. Our officers are, individually, the best in the world, as much by reason of the dignity of their character as by their professional worth and their general education. Our ardent patriotism has enabled us to make the most strenuous financial exertions.

Generally speaking, the raw material which we have at our disposal is of the first order. It is important that this should be developed in such a way that it will yield the best results. We should, without further delay, assemble these too often divergent and widely scattered forces, uniting them in a homogeneous whole, that they may cooperate to the best advantage in the preparation for war. The creation of an intelligent center for the navy will mark the first step towards the supreme objective.

PROFESSIONAL NOTES.

ELECTRIC POWER FOR MARINE PROPULSION.

The rapid development of the applications of electricity to all kinds of purposes on land, ought not to be allowed to obscure the peculiar fitness of the same agent for the propulsion of certain classes of vessels. Mr. T. C. Child calls attention to this fact in an article in the *Engineering Magazine*, and advocates the use of accumulators for the propulsion of ferry-boats and torpedo-boats. The great weight and small storage capacity of accumulators are far less serious disadvantages afloat than in the case of vehicles on land, although a complete electric-launch equipment weighs about 250 pounds per horse-power, with an endurance of one hour—about four times as much as a steam-power plant for the same duty; while other considerations arise which may in some cases completely turn the scale in favor of electricity. Where a number of ferry-boats are employed to maintain a regular service, by charging the batteries at constant pressure at the termini, the generating plant may be kept at work under the best conditions, and an important economy effected; while in the case of torpedo-boats, the necessity of speed, silence and delicacy of control makes electricity the motive power *par excellence*. The application of electricity to the propulsion of canal boats has been developed to some extent in France, but is still in a purely experimental stage; in view of our high railway rates, and the great length of canals lying almost unused in this country, the importance of a practical solution of this problem can hardly be exaggerated.—*The Steamship.*

LIFEBUOY WITH ELECTRIC SIGNAL LAMP.

The greater part of loss of life in connection with shipwrecks at night is due to the inability of the victims to get hold of an object which will keep them afloat till the lifeboats can reach the place of the disaster. The lifebuoy under notice, which is considered to supply an excellent means to cope with the difficulty referred to, consists of a large cork ring which is covered with stout sail cloth, and of an electric lantern which is mounted on a tubular pole. The incandescent lamps in the lantern receive their energy from an electric accumulator placed in a strong metal case at the foot of the lamp pole. This lantern is placed almost in the center of the cork ring and connected to it by means of a universal joint which enables the lantern to remain in an upright position while the ring is pitched into all possible positions by the waves. The reason for not placing the lantern exactly in the center of the cork ring is to create a tendency of the latter to fold into a plane with the crossbar and to fix readily to the side of vessels. The pole of the lantern passes through a crossbar which is connected with the switch of the lantern. A spiral spring is inserted between this crossbar and the lantern head and tends to put the switch "on." It is, however, prevented from doing so as long as the whole apparatus is suspended by its crossbar, as the weight of the former suffices to compress the spiral springs. But the lights may be tested while the apparatus rests on its support, and, as it leaves it and gets immersed in the water, the spring acts and the light is switched on. The cork ring is large enough to accommodate one or two people inside, and a number of rope loops are provided for others to cling to it. The accumulator is of Zerning's metalloid type, with which shifting or crumbling of the plates is said to be impossible as the interstices are solidly filled up with a substance that retains the electrolyte and prevents spilling under the most severe conditions the battery can be put to. On the other hand, the electrolyte is readily given off to the plates for the purposes of the electro-chemical action while the light is switched on. The conditions which this battery has to fulfil differ materially from those under which accumulators have usually to work, as this accumulator has only to serve for a very few discharges, but it must be able to retain its charges for a very long period. Zerning's accumulator is claimed to fulfil these conditions to a very high degree. The top of the gun-metal vessel in which it is rigidly placed has a screwed-on cover for inspection and for replenishing the electrolyte. The stem of the lantern is made of a solid drawn steel tube which offers ample protection for the leads which connect the accumulator with the lamp. These leads pass first through stuffing boxes in the cover of the accumulator before they enter the tube, the lower part of which is filled up with a suitable non-conducting material as an additional precaution. The lantern proper consists of a stout spherical glass vessel similar to those used for nautical purposes, and fitted on top and bottom with watertight gun-metal covers. Below the top cover an ebonite plate is provided which carries the terminals of the leads from the accumulator, and also two incandescent lamps with their terminals. On the bottom cover is mounted an electro-magnetic switch which throws the second lamp into circuit when the first gets unserviceable by any cause whatever. Extensive trials have been made with this electric safety buoy by independent experts, who report very favorably about it; and amongst those who have taken it up are the German Imperial Navy, who have bought a number for further trials.—*The Steamship.*

ELECTRICITY ON BOARD SHIPS.*

By S. Dana Greene.

The modern first-class battleship requires about 2000 indicated horse-power to drive all the auxiliaries at full load, and the first-class cruiser about 1200 indicated horse-power. These auxiliaries, however, are never all in use at the same time, using maximum power, and it can be assumed that about one-half these amounts (*i. e.*, 1000 indicated horse-power and 600 indicated horse-power) will be required at one time. They are scattered all over the ship, from the anchor hoist forward to the steering engine aft, and from the deck winches and boat cranes on the spar deck to the bilge and fire pumps in the engine- and fire-rooms, 30 or 40 feet below. Some of them, such as condenser, air, circulating, feed, bilge, and fire pumps and fire-room blowers, are necessarily located within the en-

* Synopsis of paper read before the American Institute of Electrical Engineers.

gine- and boiler-room compartments, where the temperatures are always high, and where steam, oil, water and coal-dust are always present in greater or less quantities. Others, located on the spar deck, are exposed to salt water and air and to the varying conditions of sea and weather.

With these scattered locations it is obvious that power, generated at a central point, must be distributed throughout the ship. For this purpose there can be used either steam, hydraulics, compressed air or electricity. Hydraulics and compressed air not only have a low efficiency of conversion (from steam) but it is difficult to prevent leaks, freezing, bursting of pipes, etc. They have both been tried to a limited extent, and both found wanting in service. This leaves steam and electricity as the two remaining systems of distribution from which to choose. As, between the two, steam has the following disadvantages:

First. Danger to life. The bursting of a steam pipe, whether in or out of a fight, is a serious matter and likely to disable any of the crew who are in the compartment where the accident occurs. It has been abundantly proven in our civil war that men will not stand up against steam or hot water, when they will face shot and shell without flinching. Many of our vessels operating in inland waters during that war had several lines of hose coupled to a hot-water tank and led out every night to guard against boat attacks. These hose were successful on more than one occasion in repelling boarding parties. While the main steam leads fore and aft can be run below the protective deck or behind the armor belt, vertical branches must run to all auxiliaries on the upper decks, and many of these must be used in action. The effect of a steam pipe carrying 100 pounds pressure bursting or being shot away in a compartment where there may be thirty or forty men at the guns or passing ammunition, would undoubtedly be to kill or disable every man in the neighborhood and demoralize thoroughly that part of the ship. On the other hand, if a wire is shot away, one or more auxiliaries may be disabled, but no one is injured; furthermore, the wire presents a much smaller target than a steam pipe, and is, therefore, less liable to injury from shot. It is always a difficult matter, too, to keep steam and exhaust pipes tight and to prevent leaks at the joints and at watertight bulkheads.

Second. Injurious heating of living quarters. Steam and exhaust pipes must necessarily run to every auxiliary, and some of the latter, such as the ice machine, anchor hoist, steering engine, ventilators, etc., are in the officers' and men's quarters, or the pipes leading to them must pass through these quarters. The heat of the pipes and engines not only makes the quarters uncomfortable, but it is impossible to prevent more or less oil and dirt around the auxiliaries. In the tropics the heat is often so great that the officers and men cannot sleep below at all. This was the case on a number of our vessels operating in Cuban waters last summer.

Third. Efficiency. Here the contrast is very striking in favor of electricity, surprisingly so to one who has not seen the actual economy figures in steam auxiliaries.

There remain the two important factors of simplicity and reliability to be considered. No one who has had experience with the modern well-designed and well-insulated carbon-brush generator or motor can have any doubt as to its greater simplicity as compared with the steam engine. There are no joints to keep tight, no nuts or bolts to set up, no packing to renew, no cylinders to cut, and only two self-oiling bearings, as compared with a dozen or more oil cups on an engine. In fact, it is difficult to imagine a simpler piece of machinery than the modern dynamo. It seems like a return to elementary principles to discuss such a point; and yet many men aboard ship imagine the dynamo a most complicated affair, simply because they know nothing about electricity and think everything connected with it is mysterious and complex. This feeling is not confined to seafaring men, as we all know.

The question of reliability is a vital one, for no matter what the advantages with respect to safety, economy and simplicity may be, if the electric auxiliary cannot be relied upon at any and all times to do its work it is a failure and must be discarded. It must not only be able to work well under normal and favorable conditions, but it must also be able to stand a certain amount of abuse and neglect. Stress of weather and other conditions particularly during a war, sometimes play havoc with the established routine of a ship, and the sailors' tools must not only be sound; they must be hardy. The normal conditions aboard ship are not favorable to ordinary electrical apparatus, but this simply means that apparatus for such work must be specially designed and built to meet these conditions. The ordinary motor would not last long under a street car; nevertheless thousands of car motors are built and sold every year which run day in and day out with a remarkable low maintenance account. Similarly, apparatus for ship work must be specially insulated, a larger margin of capacity must be allowed, and in exposed places it must be thoroughly enclosed. Several years ago an English manufacturer asked permission to install an electric deck winch on the spar deck of a new cruiser fitting out at Portsmouth. When the captain, who was superintending the fitting out of the ship, saw it he gave orders to have the deck hose turned on the motor for ten minutes, and then to operate the winch. The manufacturer protested, and said that the motor was not intended to be abused in that way. "Then take it off the ship," said the captain, "for I cannot guarantee that we will ship no seas during our cruise, and I want that winch ready for service whether we ship seas or not." The captain was quite right, the motor was taken off, and a "rough and ready" steam motor substituted.

Experience alone is the final test of reliability, and, fortunately, we have some experience in our navy on which to rely. During the late war all of our regular war vessels were fitted with electric lighting plants and many of the larger ships were supplied as well with certain electric auxiliaries, such as ventilating fans and ammunition hoists. Two of the Brooklyn's turrets were controlled by steam motors and two by electric motors. So far as I have been able to learn from both official and unofficial sources, all the electrical apparatus on these ships stood the supreme tests of battle admirably, and the officers of the Brooklyn are enthusiastic over the performance of the electrically controlled turrets. They report that with respect to ease of manipulation and fineness of control there is no comparison, but rather a contrast. This is high praise from competent authority, for the officers referred to had actual command of the turrets in battle, and their judgment is not only unprejudiced and impartial—it is final and conclusive.

It is hardly necessary to say that electric machinery, to be reliable, must have reasonable care and attention from men who know something about it. The same is true of any machinery, and it is bad policy, as well as untrue, to say, as is sometimes said by those who should know better, that an electric motor requires no attention. Cleanliness is very necessary and may be considered as a first essential to successful operation. It is astonishing to see how little has to be done to an electric motor if it is kept scrupulously clean; but this cleaning must be regular and intelligent. From what has been said it may safely be affirmed that electric machinery can be made as reliable on shipboard as any other machinery, and with this in mind we can turn to the question of efficiency, including weight of plant and first cost.

There has been very little data published on the performance of ship auxiliaries, but a valuable contribution to the subject appeared in the February (1898) number of the *Journal of the American Society of Naval Engineers*, by Passed Assistant Engineer W. W. White, United States Navy, entitled "Steam Consumption of the Main and Auxiliary Machinery of the United States Cruiser Minneapolis." This vessel, as is generally known, is a first-class protected cruiser, of about 7500 tons displacement, with three screws (each operated by its own engine) and a trial speed of over 23 knots per hour. She represents the highest type of her class, and is in every way a credit to her designers and builders. She has between thirty and forty steam auxiliaries, and more than one hundred and fifty separate steam cylinders. Her only electric auxiliaries are the lighting generators and a few small ventilating sets and ammunition hoists. In order to ascertain the steam consumption of her main engines and auxiliaries, Mr. White, who was serving on board the Minneapolis at the time as one of her engineers, made a series of careful observations during a run of the vessel of seven days from Gibraltar to League Island, Philadelphia. Indicator cards were taken on all auxiliaries fitted for the purpose (thirty-one in number), and the losses from leakage, condensation and radiation were carefully estimated, and the water evaporated carefully measured. The results obtained are certainly startling.

The average weight of steam used by the main engines per hour was 33,620 pounds, and by the auxiliaries 10,146 pounds. That is, the auxiliaries consumed nearly 25 per cent. of the total coal used. The main engines consumed an average of 20.83 pounds of steam per indicated horse-power per hour, and the auxiliaries an average of 119 pounds per indicated horse-power per hour (the lowest being 55.06 pounds and the highest 318.68 pounds per indicated horse-power per hour). These results are not exceptional; in fact, they are probably better than the average obtained on most warships or merchant vessels. The new British cruiser Powerful (14,000 tons displacement) is reported to have used 8300 tons of coal from England to Hong Kong, of which 3400 tons (or 40 per cent.) were required for the auxiliaries.

Under the most favorable conditions the auxiliaries of a large ship probably consume at least 20 per cent. of the total coal and water used. This is more than twice as great as the consumption in a modern central station, and there is no good reason why as good results should not be obtained afloat as ashore.

Let us assume a required central-station capacity for a first-class battleship of 1000 horse-power effective at the motors. The present standard e. m. f. for naval installations is 80 volts, and for the merchant marine about 100 volts. This low voltage was originally adopted on warships on account of the searchlights, which require 50 volts only, and it was desired to introduce as little dead resistance as possible. At this time no motors were, of course, in use, and the electric plant was used for lighting exclusively. Such a voltage is, however, entirely unsuited for a 1000 horse-power plant. The weight of the distribution system would not only be excessive, but the size and weight of the generators would be prohibitive. The three-wire system, or a standard 220 to 225 volt two-wire system, should be adopted, using the necessary resistance in the searchlight circuits when they are in service; since they require a relatively small percentage of the total plant capacity, and are not regularly in use, this can be done without undue sacrifice.

The generating plant should consist of several units of the same size, so that parts are interchangeable, each unit consisting of a compound vertical engine driving a pair of generators or a single generator, depending upon whether a three-wire or a two-wire system is used. Assuming an efficiency of 82 per cent. for engine and generator, and an average line and motor efficiency of 80 per cent., the total efficiency of the system (between the indicated horse-power of the generating engines and the effective horse-power of motors) is 65.6 per cent. In other words, to develop 1000 horse-power at the motors will require 1500 indicated horse-power at the engines, or about 900 kilowatts generator capacity. Six sets of 150 kilowatts each, with one reserve, would be required. A good compound engine working at approximately full load (and with six units those in actual service can always be operated at or near full load), will require 26 pounds of steam per indicated horse-power per hour. Assuming a total efficiency of the system of 65.6 per cent. as above, it will require about 30 pounds of steam per effective horse-power per hour at the motors. If we allow 25 per cent. margin for losses due to steam leakage, condensation, mechanical friction of gears, etc., we still have an economy of 37.5 pounds per horse-power per hour as against 119 pounds as shown by the Minneapolis test. In this case the auxiliaries tested aggregated 471 horse-power developed, using 56,049 pounds of water per hour. At 8 pounds of water evaporated per pound of coal the coal consumption was 7000 pounds per hour, or 84 tons per day, assuming that this power was required for twenty-four hours. If the water consumption had been at the rate of 37.5 pounds per indicated horse-power per hour, instead of 119 pounds, the coal used per day for these auxiliaries would have been 26.5 tons, a saving of 57.5 tons, or nearly 70 per cent.

It is fair to assume that by the introduction of compound engines and improved mechanical appliances on some of the auxiliaries the average steam consumption can, perhaps, be reduced to 75 pounds per indicated horse-power per hour; but this is still 100 per cent. in excess of that required for the electric drive. Assuming an average daily use of 800 horse-power effective at the auxiliaries on a first-class battleship at sea, this difference in efficiency means a saving in water used of 360 tons per day, and in coal a saving of 45 tons per day. All steam cylinders connect with the condensers, so that the water used by the auxiliaries is not lost, but is used over and over again, it being necessary to supply only that lost by leakage in the pipes and condensers. The extra pumping duty is large, however. The coal saved, on the other hand, means that with a given coal endurance (or "steaming radius") a vessel can carry from 10 to 20 per cent. less coal; or, expressed in another way, with the same coal capacity she will have from 10 to 20 per cent. greater steaming radius. The average price paid in the navy for coal (including stations in all parts of the world) is probably at least $7 per ton. There is, therefore, in the case assumed a direct saving in running expense of $315 per day for coal alone. It may be argued that a vessel in port does not use her auxiliaries to the same extent that she does at sea, and that, therefore, the comparisons made are misleading. This may be true as to actual savings in pounds of coal and water, or in dollars and cents, but the percentage difference holds true in any case. Furthermore, a ship is built to keep the sea, and her efficiency and usefulness are measured by her performance at sea, and not when incidentally or accidentally in port. Her weights are distributed and apportioned, and her power, speed and "steaming radius" are designed for sea conditions, and it is these conditions alone which should be considered.

The weight and space required for plant are important matters, for a modern steamship, and particularly a war vessel, has every available inch of space and pound of weight carefully allotted; and it is sometimes difficult for the designers to adjust the conflicting elements (which may be equally important) so as to provide for all and still keep within the prescribed limits. The present weight of steam auxiliaries of a first-class battleship, assuming a total capacity at full load of 2000 horse-power is, as before, about 200,000 pounds, or 100 tons. If the electric drive is used, we must add the weight of generating plant. The Navy specifications limit this weight at present to one-third pound per watt rated capacity. With 1050 kilowatt capacity (six units of 150 kilowatts for service and one for spare) the weight would be 350,000 pounds, or 175 tons. The electric auxiliaries would weigh about the same as steam, or 100 tons, a total of 275 tons as against 100 tons for steam drive. There would be some saving in the wiring, as against steam and exhaust pipes, so that it may be assumed that the electric plant, with the generating sets described, will weigh between two and one-half and three times the steam drive. As an offset, however, we have the saving of 10 to 20 per cent. in coal required for a given steaming radius, which in a ship of this class would amount to between 200 and 400 tons. Furthermore, if in the future a satisfactory steam turbine comparable in economy with the compound engine is developed for marine works, as now seems probable, the weight of the generating plant will be reduced 40 or 50 per cent., and then the electric drive will compare favorably in this respect with steam, and there will still be the saving in weight of coal required for a given endurance.

The space necessary for plant must be considered as one of the vital parts of the ship, and as such it must be located below the protective deck. At first thought it may be said that it will be difficult to find the necessary space, but it must be remembered that the space required for 200 to 400 tons of coal is available, in addition to the space at present allotted for dynamo room, and these combined will certainly be more than sufficient.

The application of the electric drive to the various ship auxiliaries must be carefully studied in each case. The problems involved, however, are not more difficult than many special applications on shore, nor is there anything about them which a competent electrical engineer, with a proper knowledge of sea conditions, is unable to solve. The first cost will undoubtedly be greater than with the steam drive, but the savings in "operating expenses," if capitalized, will much more than offset this difference in first cost.

The problem is purely an engineering one, and should be approached in a businesslike way. Will the electric drive be equally safe, simple and reliable, and will it be more efficient than the present system of steam drive? This is the question in a nutshell, and I believe that the figures and data which I have presented enable us to answer it most emphatically in the affirmative. Other nations, particularly, England, Germany and France, have already introduced the electric drive extensively on their ships both in the navy and merchant marine; and it is earnestly to be hoped that our own Navy, with its magnificent ships, officers and men, of whose record we are justly proud, will not lag behind in this important respect.—*The Steamship.*

THE RECONSTRUCTED CRUISER CHICAGO.

The Chicago under her new lease of life carries very little of the original material that was put into her at the time of her first construction. Indeed, it may be said that the mere shell of the vessel is all that remains of the work done in Roach's shipbuilding yard. In the first place her engines and boilers are entirely new, and are of an improved and thoroughly modern type. Her protective deck, which formerly extended merely above the vitals of the ship (the engine- and boiler-rooms), has now been carried forward and aft to the stem and stern, so as to make a continuous armored protection throughout the ship. And not only the main engines, but all the various auxiliaries with their steam piping and general fittings, are entirely new. In the armament only the heavy 8-inch guns have been retained. The whole of the battery of slow-fire guns on the gun deck has been replaced by a battery of fourteen 5-inch rapid-fire guns of the latest navy type, and the secondary battery of 6-pounders and 1-pounders has been disposed to suit the improved arrangements of the superstructure and the fighting tops.

The great change in the outward appearance of the vessel is due to the alteration in her rig. When she returned from her last cruise she carried her familiar bark rig, with heavy yards on the fore- and main-masts and a complete bowsprit and jibboom. The yards and jibboom have disappeared, and with them the mainmast, so that the ship now carries two masts (fore- and mainmast) of the usual military type, with a fighting top on the foremast in which are carried two 1-pounder guns, and just below the fighting top a searchlight platform, which is sponsoned out in front of the mast. There is a small signal yard on each mast and a gaff on the mainmast. These changes in her rig, together with the lengthening of the smokestacks, which now extend some eighty feet above the grate bars, have completely changed the appearance of the Chicago, and have given her a much more ship-shape and business-like appearance judged by the modern standards of warship design.

The most important changes in the ship are, of course, those which have been made in the motive power, as may be judged from the fact that the horse-power has been raised from 5000 to 9000, and the speed from about fifteen up to eighteen or possibly to eighteen and a half knots an hour. The machinery of the original ship was of a curious and cumbersome type. It consisted of two heavy compound engines, the cylinders of which were connected to overhead, athwartship, walking beams, which served to drive the crankshafts on the opposite side of the vessel. Thus the starboard cylinders drove the port screw shaft, and vice versa. The boilers were even more out of date, if that were possible, than the engines. They were of the externally-fired return-tube cylindrical type, the furnaces being bricked up around the outer shell. The boilers have been replaced by six Babcock & Wilcox water-tube boilers and four Scotch boilers. With a view to testing the merits of nickel steel for boiler construction, one of the Scotch boilers was built of this material, and if the results in respect of corrosion and general durability are satisfactory, it is probable that nickel steel will be largely adopted for boiler construction. The greater tensile strength of the alloy, as compared with common commercial steel, will enable a considerable reduction to be made in the total weight of boilers for a given horse-power. The Babcock & Wilcox boilers average about 64,200 pounds in weight, with all attachments, but no water. The weight of water is 11,930 pounds; the total heating surface for the six boilers is 14,700 square feet, and the total grate area is 360 square feet, while the pressure for both types of boilers is 180 pounds. The average weight of the Scotch boilers, empty, is 81,400 pounds; the weight of water is 40,430 pounds, the total heating surface is 8562.6 square feet, and the total grate area is 273.52 square feet. It is interesting to note that the weight of water used in the Scotch boilers is over three times as great as that used in the boilers of the water-tube type. The total heating surface of all boilers is 23,352.3 square feet, and the total grate surface is 633.52 square feet.

The ship is driven by twin-screw horizontal triple-expansion engines, the engines being slightly inclined. The high pressure cylinder is 33½ inches in diameter, the intermediate 50½ inches, and the low pressure 76 inches in diameter, the common stroke being 40 inches. All the valves are of the piston type, there being one single piston valve for the high pressure and two each for the intermediate and low pressure cylinders. The total indicated horse-power is 9000. The engines are in two separate watertight compartments, the cylinders being on one side of the center line of the ship, and the screw shafts on the opposite side. Thus the starboard engine, or the engine driving the starboard propeller, has its cylinders lying on the port side of the ship, while the port engine has its cylinders lying on the starboard side.

The ship is provided with a well-found machine shop, in which motive power is furnished by a Greenfield vertical engine. The tools consist of two lathes, two drill presses, one shaper, one emery grindstone, and various machine shop etcetera, besides a well-found bench for vise work.

The system of ventilation has been well worked out. The engine room is ventilated by both exhaust and forced blowing and the ship ventilation is arranged on the same system. The ship is provided with an Allen dense air ice-machine, connected to a freezing box and a cold storage room. The coil also passes through the scuttle-butts to provide cool drinking water for the crew.

Of almost equal importance to the radical changes which have been made in the motive power is the extensive re-armament of the ship which has taken place. The old 8-inch guns which are carried in sponsons on the main deck are retained. They are thoroughly serviceable weapons of the same type as those which did good duty at the battle of Manila Bay on the Baltimore. The gun deck broadside battery of five slow-fire 6-inch guns and four slow-fire 5-inch has given place to a battery of fourteen 5-inch rapid-fire guns. To keep pace with the increased demand for ammunition by the rapid-fire weapons, new electric ammunition hoists have been built into the ship. They are of the endless chain pattern and are capable of putting the ammunition on deck considerably in excess of the ability of the guns.

An interesting installation on this ship is the system of hydraulically operated watertight bulkhead doors invented by Mr. F. T. Bowles of the construction department of the United States Navy. This device, known as the "long arm" system, secures doors which will open and close again tightly under a head of water, and they will close tightly through a doorway full of coal. All the doors can be actuated by a single operator, who from his station on deck can move any single member of the system. The advantage of this concentration of control in case of flooding through attack by the ram or torpedo is obvious.—*Scientific American.*

OUR LATEST BATTLESHIP, THE KEARSARGE.

The Kearsarge and her sister, the Kentucky, will, in some respects, be the most interesting vessels of the new navy; for apart from the fact that they will represent the latest efforts of the Bureau of Construction and Repair and our leading shipbuilders, the vessels possess peculiar interest on account of some decidedly novel features in their design and construction. We refer to the manner in which the main and intermediate batteries are carried, the method of mounting them being known as the double-decked turret system. The system can best be understood by comparing it with the plan adopted in the case of the Iowa, the latest of the large battleships completed for our navy. In the Iowa the main battery of 12-inch guns is carried on the center line of the ship, two of the guns in a turret forward, and two in another turret aft. The intermediate battery of 8-inch guns is carried in four turrets at the four angles of the central armored citadel, amidships. As there are two of these guns in each turret, the intermediate battery is seen to be of a very formidable character.

This arrangement of the main battery in fore and aft turrets, with the turrets of the intermediate battery flanking it, the two 8-inch forward turrets being aft of the forward 13-inch turret, and the two after 8-inch turrets being forward of the after 13-inch turret, also characterizes the three ships of the Oregon class. It provides an unusually powerful "end-on" fire, the concentration ahead or astern being, in the case of the Iowa, two 12-inch and four 8-inch, and in the case of the Oregon, two 13-inch and four 8-inch guns. In the gun trials of the Oregon type, however, it was found that in firing ahead, the blast of the 8-inch guns affected the officers in the sighting-hoods of the 13-inch turrets, if the former were fired closer than within 10° of the longitudinal axis of the ship. This difficulty has been overcome in the case of the Kearsarge and Kentucky in a novel and somewhat daring manner. Four of the 8-inch guns were thrown out altogether and the remaining four were mounted in two turrets, which were superimposed upon the roofs of the 13-inch turrets. By this distribution, not only were the defects of interference overcome, but a more efficient all-round fire was obtained. Though only half the number of 8-inch guns and turrets is employed, the all-round fire from this caliber is better than is possible in the earlier battleships; for on the broadside it is the same, and dead-ahead fire is now possible without interference with the 13-inch gun positions. The 8-inch turrets have been changed from the original designs so as to enable them to be trained independently of the 13-inch turrets—a most important modification.

As regards the rest of the armament, the principal change is substitution of a secondary battery of fourteen 5-inch rapid-fire guns in place of the four 6-inch guns of the Oregon or the six 4-inch guns of the Iowa. So large a battery calls for a large supply of ammunition and a wide area of armor protection, but the throwing out of four 8-inch guns and two turrets placed a large amount of weight at the naval architect's disposal, which he was able to use advantageously in a powerful secondary battery. The great rapidity of fire in the 5-inch battery greatly outweighs the heavier weight of the 8-inch guns which it in part displaces. In sixty minutes' fighting one broadside of seven 5-inch guns could fire fifty-six shells weighing in the aggregate nearly 3000 pounds at a velocity of 2300 feet per second, the total energy of which would be equal to 102,704 foot-tons, sufficient to lift the ship itself 9 feet bodily into the air. The accompanying table shows the broadside discharge:

BROADSIDE DISCHARGE OF THE KEARSARGE.

Number of Guns.	Diameter in Inches.	Weight in Pounds.	Velocity in Foot-Seconds.	Energy in Foot-tons.	Total energy.	Penetration in Inches at Muzzle.	Point of Attack in Enemy.
4	13	1,100	2,100	33,627	134,508	34.6	Belt and main turrets.
4	8	250	2,150	8,011	32,044	21.6	Conning tower and casement armor.
7	5	50	2,300	1,834	12,838	13.0	Thin armor, superstructure, and unarmored ends.

The principal dimensions of the new ship are as follows: Length, 368 feet; beam, 72 feet 2½ inches; mean draught, 23 feet 6 inches; displacement, 11,525 tons. The protection at the water-line will consist of a belt of Harveyized steel, which tapers amidships from 16½ inches at its upper edge to 9½ inches at its bottom edge. It is 7½ feet deep, 3 feet being above and 4½ feet below the water-line. This belt maintains its full thickness, as given, throughout the wake of the engine and boiler space and tapers gradually to 4 inches at the bow. Astern, it reaches to a point aft of the after barbette. Above this belt is a flat deck 2¾ inches in thickness, which extends over the engine and boiler spaces. It is continued forward to the bow and aft to the stern in a curved or turtle-back form. Above the armored deck the sides are protected by 5½ inches of Harveyized steel to the level of the main deck, and this armor is also continued to the level of the superstructure throughout the whole length of the central citadel. There are heavy armored bulkheads extending athwartships from side to side, which inclose the bases of the barbettes. The secondary battery within the citadel is also protected by 5½-inch transverse bulkheads. The 6-pounder battery of twenty guns is disposed eight on the berth deck and twelve on the superstructure deck, while the six 1-pounder guns are placed in the military tops. The vessels each carry four torpedo-tubes.—*Scientific American.*

SHIPS BUILDING FOR THE BRITISH NAVY.

Owing in part to the strike in the engineering trade, which has retarded the completion of very many vessels, in part to the extraordinary efforts of the past few years, we have to-day what is in itself a veritable navy in hand. Taking only the largest class of battleships and cruisers, thirty-five of 9800 tons and over are in a more or less advanced stage of construction, or almost exactly as many ships of the class as the whole French Navy, completed and completing, possesses. The full details of British ships building are as follows:

Battleships of the First Class.		Armored Cruisers.		Protected Cruisers.	
12,950 tons	Canopus Goliath Ocean Albion Glory Vengeance	14,100 tons 23 knots	King Alfred Africa Drake Leviathan	11,000 tons 20¾ knots	Amphitrite Ariadne Spartiate
15,000 tons	London Venerable Bulwark Implacable Irresistible Formidable	12,000 tons 21 knots	Cressy Aboukir Hogue Sutlej Euryalus Bacchante	5,600 tons 21 knots Particulars unknown	Hermes Highflyer Hyacinth A B C
14,000 tons	Cornwallis Duncan Exmouth Russell A B	9,800 tons 23 knots	Essex Bedford Kent Monmouth	2,135 tons 20 knots	Pandora Pioneer Prometheus Pyramus Perseus
	18		14		14

Besides these ships, which displace between them over 488,000 tons, or as much as the total displacement of the whole United States Navy, eight sloops, four light-draught gunboats building for the Yangtse, and about thirty destroyers, besides two first-class torpedo-boats, must be included. This gives a total of some ninety vessels in the category of ships not yet completed for the navy.

Excepting one or two of the destroyers which have been singularly and most unaccountably delayed, all these ships were laid down in 1896 or the following years. The general impression that it takes only two years on an average to build a battleship in England is not confirmed by an examination of the list of ships building. The first five of the Canopus class appeared in the 1896 estimate, and were laid down in the closing months of 1896 or the opening months of 1897. Not one of them is as yet complete, though the Canopus should be ready for sea this autumn. They have all been thirty or thirty-one months in hand.

Again, the intended construction of the Formidable, Implacable and Irresistible was announced in March, 1897, but they were not placed upon the stocks till just a year later, in March or April, 1898. If, as should always be the case, we reckoned the time taken to construct a ship from her first appearance in the estimates to the completion of her trials, three to three and a half years would be the average for the larger vessels. Yet even this figure, though at first sight not very wonderful, compares favorably with the results obtained in other navies. Russia, however, has lately taken to buying ships in the United States and a large cruiser ordered last year for her will be delivered this year, while a battleship, also ordered last year, will be ready next spring.

One fact which appears from the table given above is the large number of ships of each type that we build. In battleships, for instance, we have three groups, each of six ships all identical. The groups are further very similar in offensive and defensive power and steaming radius to each other, so that they are well adapted to act in unison. All have water-tube boilers, which, in spite of the furious and prejudiced attacks now being made upon them, have been adopted by every navy in the world. The fastest group of the three is the Cornwallis type, the ships of which will steam 19 knots with natural draught; the Canopus class is expected to do 18¼ to 18½ knots, and the Formidable class 18. All are almost identical in armament; each carries four wire 12-inch guns and twelve 6-inch quick-firers, besides a small number of 12-pounders and 3-pounders. In this latter direction they are far more weakly gunned than the new Russian ships, which carry forty-six small guns against our Cornwallis's eighteen.

In outward appearance it would take a trained eye to distinguish between the various types. They appear very much the same with two funnels, two military masts, and the high freeboard which is now inseparable from our ships. Great seaworthiness and extreme endurance are aimed at by Sir William White in his designs, and generally obtained. As for the steaming power of his ships, we may note that the Renown, with one screw damaged, crossed the Atlantic at a uniform pace of a little over 15 knots, or about 4 knots more than the Oregon made on her record voyage. The Cornwallis class, with full load, should be good at sea for 17½ or 18 knots.

Next in importance to the heavy battleships come the armored cruisers, of which so many are building for the navy. These are virtually battleships, in which protection and armament are somewhat reduced to get a higher speed. Far the finest are the four improved Powerfuls, known as the Drake class. The Powerful had no plating on her side; these ships have 6 inches of Krupp steel. The Powerful only carried two 9.2-inch and twelve 6-inch guns; these have two 9.2 and sixteen 6-inch guns. Lastly, the Powerful steamed only 21.8 knots; these are to steam 23. They will be huge four-funneled vessels, in general outward appearance differing little from the Powerful. Like her, they will be at home in any sea, and able to face the worst weather. In fighting qualities, they are fully equal to most British and foreign battleships of not the most recent construction.

They are followed by a class of six armored cruisers, smaller, slower, not so heavily armed, but all the same of 12,000 tons, known as the Cressys. They are to steam 21 knots, and carry the same battery as the Drakes, except that they have four less 6-inch guns. They also are, and are designed to be, something very near a battleship. Admiral Sampson of the United States Navy is inclined to think that this class of powerful armored cruiser will gradually displace the slower and heavier battleship. If so, it is thoroughly satisfactory to reflect that we have so many of the kind in hand.

The smallest of the armored cruisers, the Essex class, are not the least interesting; they will, probably, have three funnels, differing in this respect from the preceding, which have four. They are to steam 23 knots, and will carry fourteen 6-inch guns, all behind 4-inch armor, while armor of the same thickness will protect their water-line. They are splendid designs, combining all the ideal features of the cruiser, and should be much superior to the American armored cruisers Brooklyn and New York, which did such good service in the late war.

The first six in the list of protected cruisers have been often described.

The Amphitrite and her two sisters are reduced copies of the Powerful, and are defective from their want of side armor. The Hermes is a good specimen of the moderate sized heavily armed cruiser. As for the new ships, A, B, C, they are to be of different type, and should steam 25 or 26 knots to meet the Russian cruisers of the Novik class, two or three of which are to be ready in 1900, and which are to steam 25 knots. In 1890, 19 or 20 knots was considered a fair speed for a small cruiser, but lately sharp competition between the powers has sent up speeds very much, while the water-tube boiler gives the designer plenty of power on a low weight. The small cruisers of the P class are not very interesting; several are already in service, two with the Channel Squadron. They are seaworthy, but not very fast, and are rather lightly armed. The sloops are rigged to use sail power as well as steam, and are useful little ships for colonial service. They draw very little water and are meant for police purposes rather than for fighting. Ships of this class in the United States Navy, however, did good work on the Cuban coast in the late war.

Of the light-draught gunboats, one, the Dwarf, had her trials some weeks ago. She made 13 knots. What promises to be the fastest vessel in the world is building for the navy in the turbine-engined Viper. She is expected to go 35 or 36 knots, and her small 312-ton hull will hold machinery developing 10,000 horse-power. Yet she is only the first experiment in a new development which may give us yet greater wonders.

The total displacement of ships now under construction for the British Navy amounts to no less than 488,000 tons. There are six battleships of 12,950 tons; six battleships of 15,000 tons; six battleships of 14,000 tons; four armored cruisers of 14,100 tons, with a speed of 23 knots; six armored cruisers of 12,000 tons, with a speed of 21 knots; and four armored cruisers of 9800 tons, with a speed of 23 knots, besides fourteen protected cruisers.—*Black and White.*

PRESENT AND PROPOSED CRUISERS OF THE UNITED STATES NAVY COMPARED.

The recent war has imposed upon the United States responsibilities that are entirely novel and of far-reaching consequence. The battle of Manila sounded the death-knell of our policy of isolation, and the treaty of Paris so greatly extended the borders of our possessions that they may now be said to be conterminous with those of every nation that has a fighting ship afloat upon the high seas. Hence our navy has taken on a new meaning in the minds of the American people—it is no longer a mere adjunct of our coastline fortifications; it is our foremost line both for offense and defense. The countless islands of the Philippines scattered over a hundred leagues of sea call for ships that can steam both far and fast, ships which, when they have outstripped the enemy, can present a fighting line that is better able to give and take the hard knocks of a sea fight, and reasonably sure to fulfill to the letter the significant orders, "Sink or destroy."

In our issue of August 19, we gave some details regarding the plans of the proposed six new cruisers which were authorized by the last Congress, and showed that if these ships are built as designed they will be greatly inferior to ships of a similar size and type that are built or building for other navies of the world. Among the vessels selected for comparison was a United States ship, the New Orleans. We are now enabled to present for comparison the new cruiser and the New Orleans, and with a view to bringing out clearly the points of advantage possessed by one over the other we have compared the ships point by point in tabular form. We find that the full load displacement of the New Orleans is slightly over 3500 tons, or practically the same as that of the new cruisers. This vessel is, therefore, an admirable foil to set off the good or bad points of the new design, for not only has she been tested in actual warfare, but, like the Denver class, she is sheathed and coppered and therefore suitable for a long stay in tropical waters without docking.

We find, then, that on every point but one the New Orleans shows a superiority, and on some points an overwhelming superiority, over the proposed cruisers; for she has 4½ knots more trial speed, she carries 100 tons more coal, has a 1¼-inch protective deck as against none, and has 3 inches of armor along the side slopes of the deck as against 2 inches for a third of the length; she carries 407 men as against 290; she has at present two torpedo-tubes as against none, and her battery is heavier and more numerous. And yet the New Orleans, though an ideal fighting machine, is not by any means a phenomenal boat; she merely represents modern ideas among the naval constructors of the world as to what elements should be combined in an up-to-date 3500-ton sheathed and coppered cruiser.

It will naturally be asked, What has been done with the 3500 tons of displacement in the new designs? It is reasonable to suppose that with a speed less by from 3½ to 4½ knots (for the ships according to the contract may be accepted at a reduced price if the speed is less than 16½ but does not fall below 15½ knots), with 100 tons less coal, no protective deck, no torpedo-tubes, and also with a saving in weight due to carrying 117 fewer men and their supplies—it is reasonable to suppose, we say, that some compensating advantages must appear in the new boats that are not seen in the New Orleans. There is an undoubted advantage in the fact that the new ships are to have a flush upper deck, and will, therefore, be drier boats in heavy weather, and will provide more liberal breathing space for officers and crew. The New Orleans has a forecastle deck, an open waist amidships, and a poop, whereas in the new ship the space between forecastle and poop is decked in, thereby affording an unbroken upper deck from stem to stern. This means the addition of considerable weight at a height of 16 or 18 feet above the water-line, and other things being equal, we should expect that this addition was made at the sacrifice of some other features of the ship. But other things are not equal; for even if we allow that the 1¼-inch protective deck of the New Orleans offsets the weight of a flush upper deck, that vessel still possesses a vast superiority in speed, better protection on the slopes, more coal, and over 30 per cent. more men to fight the ship; to say nothing of the superiority of her armament.

While it goes without saying that a ship with a flush upper deck is drier in a seaway than one with forecastle, open waist and poop, it has yet to be proved that it is wise to sacrifice speed, coal and armor merely to prevent a ship from throwing a little water aboard in squally weather. Unless we have altogether misread the lessons of American naval history, unless we have quite failed to appreciate the fighting spirit of Paul Jones, Decatur and Farragut, we think that the typical American seaman would be quite willing to receive an occasional swish of salt water in his eyes or a roll of green seas across his deck for the sake of an extra gun or two in his battery, or 3 or 4 knots extra speed on tap in the engine-room at the critical moment. During the operations of the late war the New Orleans was able to respond at any moment to a call from the Admiral for a 19-knot sea speed, and her varied experience in the twelve months of her service has never seen a time when she could not "cast loose" her guns for action. Seaworthiness is of course a prime factor in a warship, but in this, as in all other matters, it is possible to go to extremes. England has done so, with the result that many of her ships are, in proportion to their size, the most under-gunned vessels in the world. In our six new cruisers, it is the speed and protection that have been sacrificed.

It is claimed that another feature in which the new vessels are superior is the accommodations for officers and crew. These are stated to be very superior, a point that may well be conceded, for upon the same displacement and with hundreds of tons saved upon engine and boiler weights, protective deck and torpedo outfit, she carries only 290 men as against 407 carried by the New Orleans. Here again it looks as though a principle good in itself, and when applied in moderation, had been pushed altogether too far. Inquiry of both officers and men who have served on the New Orleans failed to elicit any serious complaints of inconvenience due to overcrowding. Give to the typical American sailor a reasonable amount of living space, and then offer him his choice between more guns, more speed and better protection, or a few cubic feet additional space in his living quarters, and he will take the ship with the better fighting qualities in every case.

It is evident from the shallow draught and short length of the proposed ships that their slow speed must be due in part to their fuller lines. Although the New Orleans is 54 feet longer, of 3 feet more draught and the same beam, her displacement is about the same. Hence it is certain that her lines must be very much finer and undoubtedly the 4½ knots extra speed is partly due to this. Again, her large horse-power (7500 as against 4500 for the new boats) is obtained without a proportionate increase in weights, by using a high speed of revolution in the engines; a principle that has been adopted with success in other ships by the same designer. Other economies in weight are due to the fact that from stem to stern there is nothing in the ship of the purely ornamental or fanciful; the broad principle of utility has been followed to its ultimate limit, and in this respect the New Orleans is more like an American production than the product of a European yard.

The effort of the department to secure ships of exceptional seaworthiness and liberal berthing accommodations is highly commendable; but we think it is evident from what we have said that the sacrifices in speed and protection are out of all proportion to the benefits secured. It would have been better to have taken the New Orleans as a basis and given her a flush deck and improved freeboard at the cost of an additional two or three hundred tons of displacement rather than to have gained roominess and comfort by building half-protected cruisers, which, by the very terms of the contract, may be thrown upon the country's hands with a speed of only 15½ knots, and this, moreover, in an age of 20-knot battleships!

COMPARISON OF PROPOSED 3400-TON CRUISERS WITH SIMILAR SHIPS IN OUR OWN AND FOREIGN NAVIES.

Name of ship	Proposed Cruisers.	Montgomery.	New Orleans.	25 de Mayo.	Puglia.	Suma.	Novik.
Name of navy	United States.	United States.	United States.	Argentina.	Italy.	Japan.	Russia.
Date	1899.	1889.	1896.	1890.	1898.	1899.	1899.
Full load displacement, tons	3400	2229	3437	3300	2650	3100	3000
L. W. L. length	292 ft.	298 ft.	346 ft.	325 ft.	269 ft.	306 ft. 8 in.	347 ft.
Extreme beam	43 ft.	37 ft.	43 ft. 9 in.	43 ft.	41 ft.	40 ft.	40 ft.
Total bunker capacity, tons	700	340	800	600	750	627	500
Trial speed, knots	16½	19	20	22.4	20	20	25
Protective deck	none at ends	none	1¼ in. to 3 in.	2 in. to 4½ in.	1 in.	1 in.	1½ in. to 2 in.
Battery	ten 5-in. r. f. eight 6-pdrs. two 1-pdr. 4 machine guns one field gun	ten 5-in. r. f. six 6-pdrs. two 1-pdr. two Colts 1 3-in. field gun	six 6-in. r. f. four 4.7-in. r. f. ten 6-pdrs. four 1-pdr. 4 machine guns. two field guns	2 8.2-in. B. L. R. eight 4.7-in. r. f. twelve 3-pdrs. twelve 1-pdr.	four 5.9-in. r. f. six 4.7-in. r. f. one 12-pdr. eight 6-pdrs. 2 machine guns	two 5.9-in. r. f. six 4.7-in. r. f. twelve 3-pdrs.	six 6-in. r. f. numerous secondary battery
Torpedo-tubes	None.	2	3	6	2	2	6

The next comparison is with the Puglia, an Italian cruiser which, if sheathed, would displace about 2800 tons and have a speed of 19¾ knots. On 700 tons less displacement, she carries a somewhat more powerful battery and 50 tons more coal, has a complete 1-inch protective deck and 3¼ knots advantage in speed, besides carrying two torpedo-tubes. This is, perhaps, the most striking comparison of all, for it shows that as compared with a boat fully 25 per cent. larger than herself, the Italian cruiser, if sheathed, would possess a positive superiority on all points of comparison and an overwhelming superiority in speed and protection.

Japan, on 200 tons less displacement (supposing the Suma were sheathed), possesses a vessel with 3¼ knots more speed, a complete protective deck, a slightly less powerful battery, and two torpedo-tubes as against none.

Finally, as showing that our 16½-knot cruisers are directly at variance with the latest trend of ideas in naval construction, we quote the cruiser Novik, now under construction in a German yard for the Russian Navy. She is said to be the first of a fleet of ten similar ships, whose designer represents the theories of Admiral Makaroff, one of the most brilliant and thoughtful naval strategists of the day. This vessel is to combine the qualities of the torpedo-boat destroyer and the cruiser; and with her armament of six 6-inch rapid-fire guns, and numerous secondary battery, combined with six torpedo-tubes of the under-water type, her offensive qualities may be said to be at least equal to those of the 16½-knot cruisers. If sheathed, the Novik would displace 3200 tons. On 300 tons less displacement, she carries 200 tons less coal than our proposed boats, but, as against this, she has a complete protective deck, 1¼ inches on the flats and 2 inches on the slopes. It is when we come to the comparison of speed, however, that the enormous disparity between the two boats is seen, for the Novik will be 50 per cent. faster, having a speed of 25 knots as against the 16½ knots of our cruisers.

If the facts of the above comparison prove anything, they establish that if we build the six proposed cruisers we shall possess a class of vessels regarding which we shall be bound to admit that, for their size and date, they are the slowest and most defenseless vessels in the world, and quite unable to stand comparison with similar foreign ships in military, tactical or strategetical efficiency.—*Scientific American.*

THE IMPERIAL JAPANESE BATTLESHIP HATSUSE.

Elswick has turned out many important warships in its time, but the first-class battleship Hatsuse, launched for the Imperial Japanese Navy on Tuesday, June 27th, last, by Madame Arakawa, exceeds all others in importance, since she is the last word in naval architecture to date. Her principal details are as follows:

Displacement	15,000 tons.
Length—between perpendiculars	400 ft.
Beam	76 ft. 6 in.
Depth	43 ft. 11 in.
Draught—mean	27 ft.
Indicated horse-power	14,500 tons.
Contract speed	18 knots.
Coal supply—normal	700 tons.
Bunker capacity	1690 tons.

Armament—Four 12-in. new type rapid-fire Elswick.
Fourteen 6-in. 45-caliber Q. F.
Twenty 3-in. Q. F.—12-pounders.
Eight 3-pounders.
Four 2½ pounders.
Four submerged torpedo-tubes, one above water in stern.

Armament.	Hatsuse. (Japanese.)	Majestic. (British.)	Canopus. (British.)	Formidable. (British.)	New Maine. (U. S. A.)	Retvisan. (Russian.)	K. Potemkin Tavritchesky. (Russian.)
A—12-in. rapid-fire	4	—	—	4	4	4	4
" ordinary	—	4	4	—	—	—	—
D—6-in. Q. F.	14	12	12	12	14	12	16
F—3-in "	20	16	—	16	nil	20	14
Submerged tubes	4	4	4	4	2	4	4
Armor.							
Belt amidships	*a*	*a*	*c*	*a*	*a a a*	*a*	*a*
" bow	*d*	nil	*f*	*f*	*d*[a]	*f*	nil
" stern	*d*	nil	nil	*f*	*d*	nil	nil
Citadel, lower deck	*c*	*a*	*c*	*a*	*d*	*c*	*a*
Casemates	*c*	*c*	*c*	*c*	*c*	*c*	*c*
Barbettes and bases	*a a*	*a a*	*a a*	*a a*	*a a*	*a*	*a a*
Barbette shields or turrets	= *a a*	= *a a*	= *a a*	= *a a*	= *a a*	*a*—turrets	*a a*
Protection to vitals	= *a a a a*	*a a a a*	= *a a a*	= *a a a a*	*a a a a*	*a a a a*	*a a a a*
Speed—contract—maximum	18 kts.	17½ kts.	18¼ kts.	18	16	18	18
Displacements with normal coal supply	15,000	14,900	12,950	15,000	11,500	12,700	12,500

Armor.—The Hatsuse is completely belted on the water-line, the part amidships having a uniform thickness of 9 inches. Krupp process armor; forward and aft this belt diminishes to 4 inches, while the lower deck above it, for 250 feet amidships, constitutes a citadel 6 inches thick. At either end of this citadel rise the circular barbettes, 14 inches thick. On the main deck there are each side four casemates for eight 6-inch Q. F. carried on this deck. These have the thickness, classical now to all navies except the French, of 6 inches in front and 2 inches at the back. Each casemate gun will be furnished with a stout circular shield. There is a report current, we believe, that some alteration in design will be made here, if not for the Hatsuse, at least for her sisters. The objection raised to casemates is that while they afford the maximum of protection by their stout fronts and isolation, their thin backs, though nominally proof against 6-inch shell, may soon cease to be so. In any case they are vulnerable to shot. Any projectiles hitting the main deck amidships, if they miss the casemates, stand to hit the backs of the casemates on the off side, and all might be put out of action for that cause. We do not think such an event is very probable with shell—the high explosive shell; the 6-inch shell of the future is almost certain to be exploded by the unarmored skin or else by obstructions between decks. The odds are also against common shell reaching the backs of off-side casemates intact. Shot, of course, would; but how much in the way of shot for the 6-inch guns does any battleship carry?

The question of fire—one fatal objection to the casemate system—can be dismissed at once in the case of the Hatsuse, since she will not carry anything inflammable on the main deck. Nothing remains to be considered, therefore, in the matter of shell except the problem of shells twisting between the casemates, and fragments finding their way down to the engine-room. Precautions are taken to meet this eventuality, and the only serious objection remaining is the question of assuming shot to be used to attack the rears of the casemates. In naval kriegspiel this has been evolved as one of the two possible methods of attacking the secondary armament of modern ships. It presupposed a supply of shot that the attack does not yet carry. The other attack—showers of shell directed at the ports of the casemate guns in the hopes of getting stray shells inside, or of smashing the guns—a continuous battery is no more safeguard against than a casemate, while against big A. P. shell the casemate, by isolating its result, is the best protection. On the whole, therefore, the casemate is probably best. The Russians—who have usually a large array of experimental data, not necessarily their own, to go upon—have discarded the continuous armored battery on the Sissoi Veliky and Tri Svititelia types for the casemates of the Peresviet. The Americans have abandoned the battery of the Kearsarge for the casemates of the new Maine and Alabama. To resume—on the upper deck there are six more casemates, those at the extremities firing fore and aft, the center pair being amidships. Between these, above them, and on the main deck fore and aft, the 12-pounders are carried, the distribution being thus:

			Total.
Main deck forward	2	each side	4
" aft	2	"	4
Upper deck amidship	2	"	4
Topside—boat deck	4	"	8
			20

These 12-pounders are, perhaps, the most important feature of the ship; at any rate, the most novel as compared with our Majestic, Canopus, Formidable and London classes. They are exceedingly well distributed—an absolute necessity with guns having no protection save shields, and those upon the boat deck have a splendid arc of fire. The arrangement adopted in the British Navy cannot be compared to that in this Japanese vessel.

The 12-inch guns do not call for any special comment, the circular barbette having everywhere ousted the pear-shaped type. Heavy sloping shields of hardened steel will protect the guns, which will, of course, be balanced with the central loading position to avoid any necessity of training guns fore and aft to load. One innovation deserves mention, however. We understand that for these guns Elswick will adopt a system which will allow of their being loaded at any elevation or depression, thus converting these guns into what quick-firer implies to every naval man. The essential point of a 6-inch quick-firer is that it has not to be re-laid between each round.

The protective deck behind the water-line armor belt varies from 2½ inches to 4 inches thick upon the slopes. In conjunction with coal bunkers there is, therefore, a protection to the vitals equivalent to about 30 inches of wrought iron armor, belt, coal and deck. The main deck is to some extent an armored deck also, being 1 inch thick.

It will be noted that the coal supply of the Hatsuse is, in comparison with British standards, relatively a low one. We expect to see the point seized upon as a text for dissertations upon the question of coal supply versus offense and defense, and its relation to design. Those who do so will be under a delusion. The coal supply is not relatively lowered in order to increase the armor or armament; it stands at the figure it does, not by choice of the designer, but by policy of the Japanese Admiralty, who, intending as they do to use their ships in home waters, where coaling stations are numerous, have no occasion to regard coal supply in the light that we are compelled to.

The other salient point of difference between the Hatsuse and British Navy designs is the citadel. In British ships—except the Canopus class—it is 9 inches thick. This thickness keeps out all shell, unless the Russian and American capped A. P. shell prove equal to the testing ground performances.

A 6-inch band will not keep out big A. P. shell, and there is some opening to do damage under the casemates. But big A. P. shell are necessarily few, and the damage they do with their small charges is not much greater than what shot might effect; indeed, circumstances are conceivable, and results could be cited tending to show that the solid shot is likely to do more harm. Not only may bits of armor carried through do as much harm as bits of an A. P. shell, but the intact shot has in many known instances an extraordinary way of wandering about inside a ship up and down and round corners. Nine inches is not much better than 6 inches where big shot are concerned. The 6-inch citadel means a real as opposed to a more or less nominal armoring of the bow and stern water-line, and no one any longer upholds soft ends. Naval men never did.

The 12-inch "quick-firers" have already been referred to. Practically they double the efficiency of the heavy pieces. The Hatsuse will have twenty-five Belleville boilers fitted with economizers. The heating surface will have an area of 37,936 square feet; there will be two screws.

In concluding this brief notice of a battleship that represents the last word in modern construction, we will compare her fighting elements with those of certain contemporary and earlier ships, using, for convenience, the Naval War Game notation. We may mention that in a recent number of *The Engineer* a comparison between the Shikishima—a very similar vessel—and the Russian Peresviet has already been made.

The London is simply the Formidable with *e* instead of *f* forward—3 inches instead of 2 inches. The new American ships are 18-knot Maines, of 500 tons more displacement. This comparison brings out how very similar modern designs are in many points. The variable quantities are chiefly bow belt and citadel, or armament, except in the case of the Canopus, which has weakly protected vitals, and nothing to show for it save ¼ knot extra speed.

The values of armor bearing the same letter are not always the same—the Canopus' *aa* is not equal to the Hatsuse's *aa*. Still, the difference is comparatively slight, and is purposely not accentuated because, so far as guns are concerned, what will get through one *aa* will in all probability get through the other. All the heavier ships have advantages here; they have another advantage, too—their belts are wider. The well-nigh impenetrable American belt is the merest fraction of the whole width, and the whole width is a good deal less than the Hatsuse's 7½ feet against 8¼ feet, while being a less heavy ship the seas may be expected to move her more. Further, the Maine, for some reason best known to her designers, will, we believe, like the Alabama, carry a couple of 6-inch casemates forward. How the Americans think these guns will be fought with the big guns firing over them we do not know. Twelve-pounders so placed cannot be used when the big guns are firing; but 12-pounders are carried to repel torpedo attack when the big guns would not be wanted. Six-inch guns have quite other uses. American designers, in their haste to put guns where other ships do not carry them, overlook the cardinal possibility of other designers having thought out and discarded the same thing. In addition, they should know that shooting from guns forward is never good. In our Edgar and Undaunted classes the 9.2-inch forward—carried higher than the forward 6-inch guns of the Alabama—obtain about a third only of the hits secured by the after 9.2-inch. We emphasize this point, because the disposition of the fourteen guns in the Hatsuse and in the Alabama type is a characteristic difference.—*The Engineer.*

THE BULLFINCH DISASTER.

It will be remembered that the Bullfinch is a torpedo-boat destroyer built by Earle's Shipbuilding and Engineering Company, of Hull, and is one of the 30-knot class, the contracts for which were pretty widely distributed. She is 210 feet long and 20 feet 6 inches broad, her displacement being about 300 tons, and the specified horse-power for full speed 5800 indicated. She has two sets of four-crank three-stage compound engines, the high-pressure cylinders being forward, the intermediate cylinders next, and the two low-pressure cylinders aft. Steam is supplied by four boilers of the Thornycroft type, these being loaded to 250 pounds, but this was brought by a reducing valve to 210 pounds at the engines. The vessel had run a successful trial before leaving Hull, having made 30 knots on the measured mile. On reaching Portsmouth a trial was made, which was unsatisfactory in regard to speed, but this was found to be due to the faulty state of the paint on the vessel's bottom. On a second trial the speed was well maintained, but just before the end of the three hours' run a balance-weight flew off the forward port crankshaft, falling down into the bilge, without, however, doing much damage. The balance-weights were at first of manganese bronze, but after the accident they were replaced by those of forged steel.

The six runs had been made on the Stokes Bay mile, the average speed being 29.74 knots. A run was made down the Solent until off Yarmouth, when a return trip was made until the Nab lightship was passed, after which the vessel returned, again, passing Spithead until off Ryde Middle. The engines are reported to have been working smoothly, causing very little vibration to the vessel, and with "an absence of thumping of any sort." At 1.10 P. M. the accident occurred by which eleven lives were lost.

Mr. Dathan had just gone into the engine-room, whilst a few minutes before Mr. Tyacke had gone below in the after part of the vessel, and therefore did not witness the accident. Mr. Tremayne, one of the staff of the contractors, was in the engine-room, and was most seriously injured. Mr. Dathan stated that he had just stooped to feel the brasses of the port air-pump rocking lever, when the accident happened. The engine-room was almost instantaneously filled with steam, but he dropped on his hands and knees and crawled to the foremost ladder, an exercise of presence of mind that doubtless saved his life. He managed to climb up the ladder to nearly the top, but would have fallen back had he not been assisted to the deck. In spite of his injuries, he gave orders to have the stop valves closed, and then went forward and reported the accident to the officer in charge.

What had happened to the starboard engine was that the high-pressure connecting-rod had parted at the fork, and the cylinder itself had broken for two-thirds of its circumference just below the cover-flange, and it was through this fissure that the steam escaped and scalded the men to death. The breaking of the connecting-rod had led to a bolt being shot through the bottom of the vessel making a considerable hole through which water was coming fast. Lieutenant Dineley got out collision mats and the pumps were set to work. A dredger first took the Bullfinch in tow, but she was afterwards taken into Portsmouth by a tug.

The point of engineering interest about this unhappy accident is, of course, how the connecting-rod came to give way. It was a forged steel rod supplied by Cammell's, and was bored with a 2-inch hole from end to end, the rod itself being 3½ inches in outside diameter. The manner in which it gave way was altogether remarkable, the rod splitting, or, rather, one would say, the metal parting at the top end. This "vertical fracture" proceeded some little distance, and the rod was then pulled apart. On examination afterwards, it was found that in the rod of the intermediate cylinder, of the same set of engines, there was the commencement of a similar vertical crack; whilst both the high-pressure engine and the intermediate-pressure engine of the port side had similar vertical cracks. The two low-pressure rods of both the port and the starboard sets of engines were apparently quite sound. Presumably the low-pressure stage, being divided between two cylinders, would have less power developed in either one engine.

The question turned upon faulty material or faulty design. Here we may say that we use the objectionable word "faulty" in its absolute and literal sense, and not comparatively. That something was faulty is proved by the fact that something gave way, but that is not to say that some one was to blame. Fortunately, in this case, we have the broad shoulders of Mr. Seaton on which to place the burden, and all know that Mr. Seaton is one of the ablest marine engineers of the time, and indeed, stands in the very foremost rank of his profession. He, and those who work with him, have a long series of successes to point to in the construction of machinery for H. M. Navy, and we may conclude that all reasonable precautions, and the highest technical skill were displayed in getting out the designs and superintending the construction of these engines. The cause of the accident is extremely obscure, and one quite without precedent so far as we are aware; and, although it has resulted so disastrously, we cannot see that either the contractors, or the Admiralty officials, can lay anything to the charge of their own consciences.

Mr. Seaton, who gave evidence at the inquest, perhaps not unnaturally, thinks the defect in the connecting-rod was due to faulty material rather than to an error of design; and in this he is—equally naturally—supported by Mr. Tyacke. Messrs. Cammell, whose representatives also gave evidence at the trial, as might certainly have been surmised, consider the material was all right, and—without pretending to the knowledge of marine engineering experts—think the design was capable of improvement.

However that may be, the design in its general features is not an uncommon one, and every precaution seems to have been taken, so far as the evidence goes, to use only the sound part of the ingot. Mr. Oram, who gave evidence in a straightforward and fearless manner, happily now characteristic of the engineering branch at the Admiralty, was inclined to attribute the accident partly to design and partly to material. He acknowledged responsibility and said that the Admiralty would profit by the experience. It is a great thing to find a Government official shouldering responsibility, fearless of the criticism of those wise after the event.

The 2-inch hole through the 3½-inch connecting-rod would give a tube with a thickness of metal of ¾ inch at the top, whilst at the bottom, where whipping strains would be more likely to be apparent, the metal was thickened to give a full inch. The rod, Mr. Tyacke said, would not be required to stand a strain exceeding 7000 pounds to the square inch, whereas the minimum test was 30 tons, and the maximum test 35 tons. The average revolutions on the run were 392 per minute, so that the change in stress from compression to tension occurred with the greatest rapidity.

Naturally the wisdom of boring the rod was called in question during the inquiry, and such a "weakening of the metal" has been denounced. Now, it is hardly necessary to state here that rods are not bored simply to save a few pounds in the total displacement of the boat, but because the connecting-rod is a part of the moving weight. It is not so much the stresses due to steam pressure that have to be considered in these very quick-running engines, as the strains that may be caused by the inertia of the moving parts. The complicated stress diagrams needed to decide what section of metal should be given cannot be taken as an absolute guide, and therefore a wide margin of safety has to be allowed, and this should cover reasonable variations in the strength of material. There appeared to be some difficulty in tracing the ingot from which the rods of the Bullfinch were made, but this may have been, as was suggested, owing to the marks having been filed off. In any case, however, there is not the slightest reason to suppose the Admiralty requirements were not satisfied. These demand that 30 per cent. of the top of the ingot should be cut off in making the bloom from which the rods were forged. Three per cent. is also required to be removed from the bottom end in making the forging. As a matter of fact, we are informed that Messrs. Cammell only used 38 per cent. of the ingot in making this forging. The bender pieces are 6 inches long and 1 inch square, and were bent to 180 degrees without breaking. In the tensile tests the metal had to undergo an elongation of 27 per cent., and to stand a strain of 30 to 37 tons to the square inch. The analysis of the metal from which the connecting-rods of the Bullfinch were made was produced at the inquest, and was said to be normal, with no excess of sulphur.

The form of the fork end of connecting-rods is a matter that will doubtless be carefully considered by contractors, and at the Admiralty just now. At present the ordinary U-form of fork is usually adopted, but it may be questioned after this whether a V-shape, or, perhaps, rather a Y-form (the stem of the Y forming the top end of the connecting-rod) may not be preferable. With the extremely rapid alternation of stress before referred to it is highly desirable to dispose the metal as nearly as possible in line with the stresses, both those due to steam pressure and to inertia. It will be seen that the flat-bottom part of the U-shaped fork does not comply with this requirement so nearly as the V-shape. If we carry the U-form to an extreme, and suppose the jaws of the fork separated by a considerable interval, so as to get a wide flattened bottom to the fork, it will be seen how pressure transmitted through the gudgeon-pin to the jaws will tend to break the cross-piece forming the bottom of the fork owing to the bending stress thus applied. From this point of view the extension right to the top of the hole bored in the connecting-rod is bad, as it takes away metal where it is most required. Mr. Seaton very properly objected to a partially bored connecting-rod on account of the weakness incidental to a change of section. It is possible, however, that the hole might be made near the top in steps of lessening diameter, the steps afterwards being machined to a gradual slope by a taper reamer, or, of course, the metal could be added to the outside, but this would give a clumsy appearance.

The method of fitting the gudgeon also bears strongly on this point. For big engines the arrangement of brasses in the jaws of the connecting-rod fork is considered the most convenient, and for the comparatively few reciprocations of large marine engines the advantages of this method are apparent. For high-speed engines, however, there is the very serious objection of having four bolts and four nuts to tighten up equally and accurately. Mr. Tyacke stated that it was reported to him before the trial that every bolt, nut, and pin had been overhauled and set up, and no doubt with so good an engineering staff as that of the big Hull firm no pains were spared to get everything into perfect going order. Even the most careful attention, however, is not always sufficient to insure accuracy in such details as these, and it is only by long training in this special class of work that men can be depended upon to know exactly what to do; even then they must be specially gifted for the work. For this reason two bolts are better than four; it is evidently easier to get two set up equally than to get four set up equally. Moreover, it is preferable to have the gudgeon shrunk into the connecting-rod fork, and have the brasses on the piston-rod, because this arrangement lends itself more readily to the two-bolt arrangement, but beyond this the pin is an important element of strength in holding the jaws of the fork end together more firmly than they otherwise would be. The slacking back of nuts is a very important detail to provide against, and a small defect in this particular may upset very careful calculations as to stresses. A good deal of ingenuity has been expended on this problem by the builders of these small high-speed craft. This danger again points to the desirability of two bolts rather than four.

We notice that Mr. Seaton no longer thinks steel preferable to iron for resisting violent stresses, the present accident contributing to shake his faith in steel. This is the kind of reactionary statements that one often hears after an accident, but we do not think Mr. Seaton will be likely to put iron connecting-rods into destroyer engines in future. For our own part, the only breaking of a connecting-rod in a torpedo craft we ever witnessed was that of an iron rod, and the accident was very much on the same lines as that to the Bullfinch, the air pump being quite demolished by the flail-like action of the broken rod. Fortunately, however, no lives were lost, as the cylinders stood the test. This was in the early days, and we had a feeling in regard to the material for connecting-rods very similar to that which Mr. Seaton has expressed, only in exactly the reverse direction. It is true that with a homogeneous material like steel a crack once started is likely to go right through, whilst with a laminated substance like wrought iron there is an arrestation due to some providential cause; perhaps that surface-tension which is made to account for so many things we cannot otherwise explain. A short time ago there was another destroyer accident, through the fracture of a steel connecting-rod bolt, which gave way from the bottom of the thread just below the nut. This was doubtless due to a "tearing action," which, once started, there was nothing to stop. If a nut does not bed fairly and evenly on the surface against which it abuts, there is naturally a tendency on reversal of stress to bend the bolt, and if the bolt fits its hole exactly it cannot bend, and thus may be cracked across. For this reason some engineers make the hole larger than the bolt near the end, so as to afford a certain amount of give and take. But if we allow for all these points in favor of iron, we have yet the greater strength of steel to prevent the crack being started. A good many engineers go higher than Mr. Seaton when they have a free hand, 36- to 40-ton steel being used for some destroyers' engines, whilst the locomotive engineers go as high as 50-ton steel.

There is one circumstance that recent experience has brought home very forcibly, and that is how the introduction of the water-tube boiler has removed the source of anxiety from the stokehold to the engine-room. Formerly the danger with these excessively high-speed craft was nearly all with the boilers. The engines would take, with only ordinary precautions, all the steam the boilers could generate. Now it is not a question of getting steam, but of using it when supplied. If we were content to go back to our old speeds and old total weights of machinery, high-speed marine practice would be a very simple matter. However, we cannot afford to do that; unless other countries will agree to do the same we must still run risks, even such risks as those which led to the terrible calamity that overtook the poor fellows who lost their lives in the Bullfinch disaster.—*Engineering.*

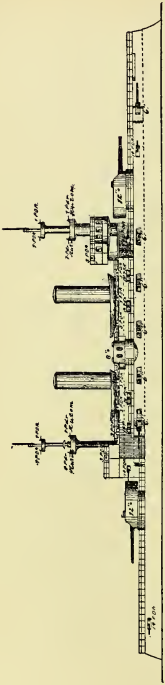
PROPOSED ARMAMENT FOR OUR THREE LATEST BATTLESHIPS.

By the courtesy of Rear-Admiral O'Neil, Chief of the Naval Ordnance Bureau, we are enabled to reproduce the accompanying plans, which were submitted to the Bureau of Construction as suggestions in regard to the armament and armor of our three latest battleships, New Jersey, Georgia and Pennsylvania, authorized by the last Congress. They show the many improvements which are possible on a given displacement as the result of the greatly increased resisting power of the latest type of armor and also as the result of the increased energy due to longer guns and higher velocities.

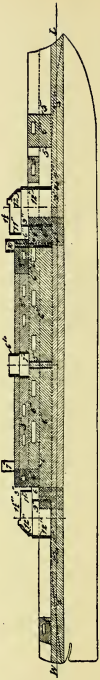
Our Construction Bureau has never turned out a more creditable design than that for the Alabama class of battleships, and we notice that in the successive designs, first of the Maine and now of the New Jersey class, the Bureau has wisely maintained the general distinctive features of the Alabama and merely added such improvements as were possible owing to the general advance which has been made in guns, armor and motive power.

Rear-Admiral O'Neil has prepared five separate plans for the new ships. They all possess the highly meritorious and characteristic features of carrying extremely powerful batteries and being provided with a very complete system of protection. While all of the designs are creditable, we must confess that the first of them, known as type A, of which we present two different views, appeals to us as being decidedly the most efficient, and containing the best combination and proportion of the different types of guns. The five designs are identical in displacement, speed and in the arrangement of the protective armor. Each plan, moreover, provides the same number of guns of each caliber and the same distribution in the secondary batteries, indeed the only modifications in the plans are those relating to the main battery in which are included the armor-piercing guns and the heavier rapid-fire weapons above 6 inches in caliber.

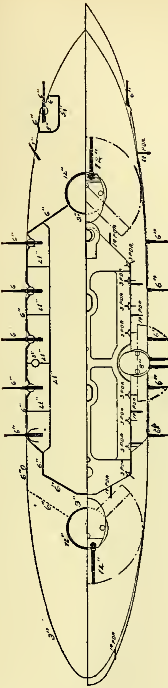
The distribution of the armor is in every way admirable, and is far more complete than anything that has yet been attempted in any of the navies of the world. In the first place, there is a complete water-line belt 8 feet in depth, which extends from stem to stern. It is 9 inches thick at its upper edge and carries this thickness for a depth of 4½ feet, from which level it tapers gradually to 6 inches at the lower edge. This belt maintains these thicknesses over that portion of the ship extending between the 12-inch turrets, and at its extremities transverse bulkheads, 9 inches in thickness, extend diagonally inward to meet the barbette armor of the 12-inch guns. From abreast of these barbettes to the stem and stern the water-line armor is gradually reduced to 4 inches in thickness. From the top of the water-line belt to the level of the upper deck, and extending forward and aft, as shown on the plans, the sides are protected by 6-inch armor, at whose ends are diagonal walls 6 inches in thickness, the whole forming a complete central casemate or redoubt, within which are placed ten of the 6-inch rapid-fire guns. Every 6-inch gun is further protected on both sides by splinter bulkheads 2½ inches in thickness, and each of these separate casemates is closed at the rear by bulkheads of 2½-inch steel. The 6-inch guns in the bow of the vessel on the main deck are each protected by a complete casemate 6 inches in thickness on the



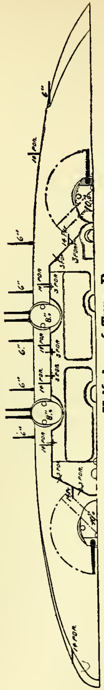
Side Elevation of Proposed Battleship, Type A.



Armor Protection for the Five Types of Battleship.



Half-plans of Upper and Main Decks, Type A.



Half-plan of Type B.

ALTERNATIVE PLANS FOR THE PROPOSED BATTLESHIPS OF THE "NEW JERSEY" CLASS.

outside, and with walls 5 inches thick in the interior of the ship. These casemates, like the main central casemate, extend from the protective deck clear to the upper deck. Above the central 6-inch gun redoubt there is another complete redoubt of 3-inch steel, within which is carried a battery of twelve 3-inch 14-pounder guns. There are also two 14-pounders on either bow on the main deck, just abaft of the 6-inch bow guns, while two others are placed on either quarter near the stern on the berth deck, all four of these guns being also protected by 3-inch armor.

The deck protection is also very complete. A protective deck, which is 2½ inches in thickness on the flat and 3 inches in thickness on the slopes, extends throughout the vessel. The deck above the central casemate or redoubt, in which the 6-inch rapid-fire guns are located, is to be of 2-inch plates at the extremities of these casemates, as shown in the accompanying armor plan. The barbettes for the 12-inch guns will be 12 inches in thickness outside the diagonal armor and 9 inches in thickness on the inside, while the turrets are to have 12 inches of armor for the inclined port plates, the sides and the rear plates are to be 11 inches, and the top plates 1½ inches thick.

Amidships, on each side of the vessel, are to be a barbette and turret for a pair of 8-inch guns, the barbette armor to be 7 inches and the turret armor 6 inches in thickness, while an 8-inch ammunition tube will extend down to the protective deck. Forward, above the 14-pounder battery, will be a conning tower with 10-inch armor and a 6-inch armored tube below leading to the protective deck, while aft, standing above the 14-pounder redoubt, will be a signal tower protected with seven inches of steel.

The armament will be extremely powerful. The main battery will consist of four 12-inch guns, 40-caliber guns each of 58,221 foot-tons energy, disposed in the two main turrets fore and aft; four 45-caliber 8-inch rifles, each of 13,602 foot-tons energy, disposed in the two turrets amidships on either beam; and twelve 6-inch 50-caliber guns each of 5838 foot-tons energy, carried in the closed central casemate and the two bow casemates on the main deck. The secondary battery will consist of sixteen 3-inch 14-pounder guns, sixteen 3-pounders, sixteen 4-shot automatic 1-pounders, six single-shot 1-pounders, ten machine guns, and two field pieces.

There is no ship afloat carrying a battery of such enormous energy as this, although by the time these three vessels are afloat—such is the rapidity of the development of naval armament—it is probable that they will be equaled, if not outmatched, by vessels already built or building in other parts of the world.

We welcome the return of the 8-inch gun. It proved itself to be the most efficient weapon used at Santiago and Manila, for although the hits were not as numerous as those made by the rapid-fire weapons of 6 and 5-inch caliber, the destructive effect was greater than that of any other type of gun carried in the war.

One of the plans herewith reproduced shows a modification in which there are eight in place of four 8-inch guns, arranged in four turrets, two on each beam. There are two other plans identical with this last except that one of them substitutes four 10-inch guns for the 12-inch, and the other substitutes two 10-inch and two 12-inch for the four 12-inch. In the second, third and fourth plans the fore and aft fire is the same as in the first plan, while the broadside fire is increased by two 8-inch guns. The fifth plan differs from all the others in having no 8-inch guns and in carrying sixteen instead of twelve 6-inch guns, eight of these firing on each broadside, four dead ahead and two dead astern. We think it is likely that the first of these designs will find most favor with our naval officers.

If, on a displacement of 13,500 tons, the Construction Bureau succeeds in building ships with this magnificent system of protection with such an unprecedented battery and with 18 knots speed, without reducing the necessary amount of stores, ammunition and berthing accommodation, it will produce by far the most effective battleship that the world has ever seen.—*Scientific American.*

THE SPEEDS OF BATTLESHIPS.

A service contemporary, in discussing the naval manœuvres, lays down as its opinion that the "subsidiary object" of the manœuvres is to test the value of speed in battle squadrons, and, of course, refers to speed as the essential thing for modern battleships. Everyone does this, or rather nearly everyone who writes about the matter, saving an isolated Frenchman or two. Americans, who used to hold that there were other things as important as speed, have now discarded the idea. The root of the axiom is that other axiom, that "the fleet of greater speed can seldom, if ever, be forced into action by a fleet of inferior speed."

Now, without posing as heretics, we cannot help thinking that, as things are, there is a good deal more to be said for the French case than on paper is at first sight apparent. And we believe that—confining the contention, of course, to reasonable limits—there is a large body of professional opinion more or less in line with the French idea. Speaking broadly, it is the amateur expert rather than the professional who preaches "speed is everything." The professional mind adds, "within reasonable limits," a clause that means nothing definite to the public side of the agitation for fast ships, but a very great deal to the main question, and merely paraphrases the latest French theory. It is a well-known fact that Whale Island is by no means wholly devoted to the Canopus class. Whale Island knows that an ordinary steel pointed 9.2-inch common shell has been through armor identical with that of the Canopus' belt. In theory such a hit, owing to the Canopus' system of protection, is not necessarily very dangerous, and it still leaves an intact thick deck, while there are also bunkers to localize the explosion. In actual fact there may be another side to the story. What a 9.2-inch common shell can penetrate, a 9.2-inch high-explosive is likely to get through, and its bursting and destructive power in that case is at least equal to a torpedo's, save for such localizing effect as the penetration of the armor may produce. Of course the case referred to was a remarkable experimental one, but at the same time it implies a strong possible vulnerability to the 9.4-inch and 10-inch guns carried by new German and Russian ships, unexpected, to a great extent, and to which the slightly slower Majestics are not liable. In return the Canopus gets, let us say, a knot better speed. Now, assuming the Canopus to be engaged with the Majestic, this means that in half an hour she could, whether the Majestic liked it or not, increase or decrease the range by 1000 yards. A thousand yards is not much, and hardly, we think, represents a range equal to that extra 3 inches, or, allowing for the better value per inch of the Canopus' armor, let us say 2 inches of armor. Again, what duel between modern ironclads is going to last half an hour? A three-knot difference, no doubt, would be another matter, and it might, apart from other things, confer the power to ram, which a one-knot difference certainly will not. Between being able to move a ship's length more in a fraction over a minute and in taking some four minutes to do so, the gulf is great. But to get ramming advantage out of even three knots in these days of gyroscopes and rapid-fire big guns seems a large risk. For the duel, in fine, the one knot extra speed seems useless, while even the as yet unobtained three-knot advantage seems a very doubtful gain if armor or guns have to suffer for it. The engines themselves, too, may stand to suffer. Such trouble as has come with warship engines has generally been due to a striving after lightness. In cruisers this may be accepted; a certain amount of "gingerbread" may be forgiven in a cruiser whose weapon is speed; a cruiser unit is not what a battleship unit is; a broken-down battleship may leave a mark upon the history of nations. "Make your engines strong and as powerful as may be" is not the same order as "Make your engines powerful and as strong as circumstances will admit." In the past the former has been our watchword; for the future the latter seems likely to oust it. If anything goes wrong—well, the makers of the engines or the engine-room staff are handy black sheep.

On this axle all the strategical advantages of the swifter battle squadron turn. If battleships gain their speed power by losing in guns or armor, their gain is nullified, since catching Tartars is of no supreme advantage strategically any more than tactically; while, if it is done at any expense of the engines, we have to face the question, Will the engines all stand it? To break a chief engineer and black-list a contractor will not remedy facts. We have noticed more than one indication lately on the part of the powers that be to realize this new use for engineer officers. Except for the engineer, it is a most brilliant idea—in peace time, but it will not answer in war.

To turn to the strategical value of the swifter battle fleet, we do not think the following facts are given their due weight when the question is thought out; the obvious, in fine, is given undue precedence of things less obvious indeed but equally weighty. There is no novelty about them; all have, at one time or another, been harped upon in our columns; all are patent upon consideration; but, as we remarked above, are prone to be overlooked. (1) If the enemy's ships put to sea, they will probably do so in order to fight, in which case guns and armor are of more value than speed. The theory of fleets seeking to effect combinations for ulterior objects is a general and classical one; but there is no valid reason why the necessary combinations should not be made *before* war begins. A war takes at least a month to begin now-a-days. (2) The theory of a fleet slipping out to combine with another is, therefore, overestimated. But, even if it did do so, it would be useless to catch it unless guns and armor were good enough to ensure victory. Also, so far as its *personnel* is concerned, the fleet that runs is a beaten fleet, and must deteriorate from the mere fact of running. The fleet it runs to join is also sure to be "watched," and it is difficult to conceive of two runaway fleets having sufficient speed to combine, re-form, recover *morale*, and attack one of the slower pursuers, before those pursuers are, to all intents and purposes, combined also. It is possible on paper, we know; but paper is not war. (3) In any chase certain ships of the runaway fleet are bound to drop behind, whatever speed difference there may be—this difference is never likely to much exceed two knots at the outside. The "lame ducks" must, therefore, be captured in detail, or the swifter runaway must turn and fight. (4) Generally speaking, the swift battleship has a coal supply that will run short before the slower vessel's. Her superior speed may, therefore, lure her to destruction in that way. (5) There is not a navy in the world that can put a homogeneous squadron into the field, except the British. A 15-knot squadron of homogeneous ships stands, when these are steaming together in station, to better a swifter fleet of varying units, because these last will not be able to perform evolutions together at a high speed. The amateur enthusiast for fast battleships is too apt to confound "station keeping" with cleanliness and polish. (6) Twelve knots is the highest speed at which fleet evolutions have yet been done, and that is recent. Admiral Rawson proposes to try 14 knots in the next Channel Fleet cruise; but that is possible only in a highly trained, regularly commissioned and homogeneous fleet. The least little error spoils everything. The only formations which a swifter hostile fleet could run away in would be loose line ahead or abreast; in both cases our cruisers would be able to concentrate on units, and to defend these units would entail slowing down and accepting battle.

There is one advantage of the runaway business—shooting from the after guns is always easier than from those forward; that is a tactical matter well known and to be adopted in general action by either side without regard to speed. A strategical position in which our ships needed to run away, and so incidentally availed themselves of this tactical advantage, is not easily conceivable. Very few admirals would dare to run, strategically; and did one do so, the damage to our prestige would be worse than a defeat. The *morale* of the man behind the gun is the dominant factor in naval warfare.

To a consideration of these points is due our regret at much of the present-day mania "for speed at all costs" for battleships. We believe, in fine, that the battleship should be a battleship, and the armored cruiser an armored cruiser. We are sceptical as to the use or need of any mean between a Majestic and an Asama; the former is better qualified for battleship work than the Canopus, and the Asama, frankly an armored cruiser, is better able to fulfill all cruiser work.—*The Engineer.*

STEAM TRIALS OF H. M. S. OCEAN.

The first-class battleship Ocean, which has been built at H. M. dockyard, Devonport, and engined by Messrs. R. W. Hawthorn, Leslie & Co., of Newcastle-on-Tyne, commenced her contract trials last week, as already stated in our report of the proceedings of the Institution of Mechanical Engineers at Plymouth.

This vessel is the first ship of the Canopus type to undergo her steam trials, and is also interesting as being the first battleship in H. M. service which has been tried with Belleville boilers, although, of course, many cruisers have passed through their trials fitted with this type of boiler. She is also of interest as being the first battleship of modern type which has ever been built at Devonport, although two other vessels, the Implacable and Bulwark, of this class are now in hand at that dockyard. The main propelling machinery of the Ocean consists of two sets of vertical three-crank triple-expansion engines. The diameters of the cylinders are 30 inches, 49 inches and 80 inches by 51 inches stroke, and the engines are designed to run at 108 revolutions per minute for indicating full power. All the cylinders of the engines are fitted with separate liners, the high-pressure cylinder being actuated by a piston valve, and the intermediate and low-pressure cylinders by double-ported slide valves. All the valves are worked by ordinary double-bar link motion. The bed-plates are of cast steel, the back columns being of cast iron, and the front columns wrought steel. The condensers, which are of cast gun-metal, have a total cooling surface of 14,500 square feet. All the auxiliary machinery usual in vessels of this class has been fitted.

The boilers, which are twenty in number, are of the Belleville type fitted with economizers, ten of the boilers having nine elements and ten having eight elements. The tubes, which are all of solid drawn steel, galvanized externally, are 4½-inch outside diameter in the generator elements, and 2¾-inch diameter in the economizer elements. The total heating surface is 35,715 square feet, of which 24,155 square feet are in the generator elements and 11,560 square feet in the economizer elements. The total grate area is 1035 square feet.

The boilers are arranged in three water-tight compartments, in two groups of eight and one group of four. The steam pressure is 300 pounds per square inch in the boilers, which is reduced to 250 pounds at the engines by means of Belleville reducing valves. The contract trials specified are as follows: (1) A preliminary trial at sea; (2) a thirty hours' trial at one-fifth power, *i. e.*, 2700 indicated horse-power; (3) a thirty hours' trial at 10,250 indicated horse-power; (4) an eight hours' trial at full power, viz., 13,500 indicated horse-power.

On July 26th the vessel was taken to sea for her preliminary trial, and the machinery was worked gradually up to about 100 revolutions. Everything worked without the slightest difficulty, and on the 27th the vessel proceeded to sea for her thirty hours' trial at one-fifth power. The results of this trial are tabulated below. The trial passed off most satisfactorily, no difficulties of any sort being experienced, the machinery running very smoothly without the slightest signs of heating. It will be noticed that the coal consumption is 1.84 per indicated horse-power. It should be mentioned, however, that the modifications which have been made to the auxiliary exhaust system in several recent ships, with such successful results in the matter of coal consumption, could not be carried out on board the Ocean without delaying the trials, and it was therefore decided that these modifications would be made after the ship was taken over. The further trials are being continued this week. The Engineer-in-Chief's department of the Admiralty was represented on the trial by Mr. Ellis, the machinery being in the charge of Mr. D. C. Beadon on behalf of Messrs. R. and W. Hawthorn, Leslie & Co.

MEAN RESULTS OF THIRTY HOURS' TRIAL.

		Starboard.	Port.
Mean steam in boilers		210	210
Mean steam at engines		184	184
Mean vacuum		27.8	27.5
Mean revolutions		66.6	67.0
Mean pressure in cylinders.	High	41.6	38.2
	Intermediate	16.2	15.4
	Low	4.6	4.2
Indicated horse-power.	High	506	466
	Intermediate	527	501
	Low	398	369
Total indicated horse-power		1431	1336
Gross total indicated horse-power		2767	
Coal per indicated horse-power		1.84	
Speed		11.4	

ON ELSWICK CRUISERS.*

By Mr. Philip Watts, Member of Council.

I purpose in this paper giving some particulars of Elswick cruisers built during the last ten years. In the Esmeralda, built in 1882-3 from designs by Mr. George Rendel, considerable advance was unquestionably made towards what may be called the modern protected cruiser. The features which it was sought especially to develop in the design of this vessel were—first, great speed and manœuvring power; secondly, exceptional power of attack; thirdly, protection other than by side armor. Lord Armstrong advocated this class of vessel in the early days of protected cruisers almost to the exclusion of armorclads, and before the introduction of high explosives there can be no doubt that such vessels were very much more on an equality with armorclads as fighting ships than they have been since.

Particulars of the Esmeralda are given in Table I. She was 270 feet long, of 2950 tons displacement. Her engines were of 6083 horse-power, and she attained a speed of 18.3 knots. Her armament consisted of two 10-inch guns, six 6-inch guns, and a number of smaller guns. Her machinery, magazines, &c., were wholly below the water-line, and were protected by an arched deck of 1-inch armor from stem to stern.

After the Esmeralda, the Giovanni Bausan was built, practically from the same designs, and later the Naniwa Kan, Dogali, Chih Yuan, and Ching Yuan were also built by my firm from designs by my predecessor, Sir William White. The Dogali was of 2050 tons displacement, some 950 tons less than the Esmeralda, but she steamed at 19.6 knots speed. Her armament consisted of six 6-inch guns and a number of smaller guns, and her armor deck, which extended from stem to stern, consisted of a central flat portion 1 inch thick and sloping sides 2 inches thick.

In Tables II and III are given the dimensions, particulars, armament, protection, &c., of a number of typical cruisers completed at Elswick during the past ten years, including those of the Piemonte, which were also given in my paper to this Institution at the spring meetings in 1889.

The vessels given in Table II have protective decks and no side armor; those in Table III have side armor. The Piemonte and Yoshino have each a poop and forecastle. The other two vessels on Table II, which are upwards of 4500 tons displacement, and the three vessels on Table III, which are upwards of 7000 tons displacement, are all flush-deck ships. The Piemonte had only a single bottom, as had also the 25 de Mayo and the 9 de Julio, but the Yoshino, and all other cruisers since built at Elswick, some five and twenty in all, have been provided with inner bottoms.

Machinery, speed, &c.—The vessels given on Table I were provided with horizontal engines, but all the vessels built by my firm during the past ten years, including those shown on Tables II and III, have had vertical engines wholly below the water-line. I believe the Piemonte, laid down in 1887, was the first cruiser built with vertical engines wholly below the water-line. The advantages of vertical engines had for some time been fully recognized. They could be more conveniently balanced and brought less strain on the ship's structure, were considerably lighter than horizontal engines, were subject to less wear and tear, and wear did not throw them out of truth to the same extent as in horizontal engines; with

* Read at the summer meeting of the fortieth session of the Institution of Naval Architects, July 19, 1899.

twin-screw engines they could also be got into much less space, especially in a fore-and-aft direction, and all the working parts were much more accessible. But difficulty had been found in getting them below the water-line, and where adopted in protected cruisers great weights of armor had to be expended in protecting the tops of the cylinders, which extended some feet above the water-line.

In the Piemonte my first intention was to have two or more sets of vertical engines upon each shaft, arranged in such a way that one set only could be used for economical steaming. But this arrangement involved some additional weight, and finally I found it possible to accept a single set of vertical engines of 27-inch stroke upon each shaft. Each set of engines had four cylinders, the low-pressure cylinders being divided into two, each expanding its own condenser. This enabled well-balanced, smooth-running engines to be provided, which have proved satisfactory in every respect. The particulars of these engines were given in my paper of 1889.

All the vessels given on Table II and on Table III have been engined by Messrs. Humphrys, Tennant & Co. They all have boilers of the ordinary cylindrical type, having a working pressure of 155 pounds per square inch, excepting the O'Higgins, which has been fitted with Belleville boilers. The boiler tubes in these vessels have been fitted with Messrs. Humphrys' patent tube connections.

In the Piemonte, as I have already stated, a stroke of 2 feet 3 inches was adopted, and 7050 indicated horse-power were realized on the trial with open stokeholds, and 12,780 indicated horse-power with forced draught. The number of revolutions corresponding to these powers were respectively 160 and 185, and the corresponding piston speed 720 feet and 832 feet per minute respectively. In the 25 de Mayo, 9 de Julio, and Blanco Encalada, the low-pressure cylinders were each 66 inches in diameter, and the stroke 2 feet 6 inches. In the Yoshino and Takasago the stroke was 2 feet 9 inches, and in the Buenos Aires the stroke was 3 feet, while in each of the vessels given in Table III, the Esmeralda, O'Higgins, Asama and Tokiwa, the stroke was 3 feet 3 inches. In all of these vessels and others, at full speed with open stokeholds, the number of revolutions varied from 155 to 185 per minute. In the Tokiwa, with open stokeholds, the engine developed about 15,000 horse-power, with about 145 revolutions, and a piston speed of about 940 feet per minute; and with less than 1½-inch air pressure in the stokeholds the engines developed upwards of 20,000 indicated horse-power, with about 160 revolutions and a piston speed of about 1040 feet per minute.

It may be remarked that with this quick-running machinery low powers may be developed more economically than in slower running machinery as they are developed in smaller engines. In this respect increased piston speeds and revolutions for full powers appear preferable to the increased boiler pressures which have been adopted in many recent vessels.

With reference to the speed of these vessels, our rule at Elswick has been to aim at giving half a knot more speed than we have undertaken by contract, and with one exception we have succeeded in doing this; the one exception being the case of two cruisers recently built for a distant country, in completing the contract for which our agent exceeded his instructions, and undertook to give the half knot we had in reserve. There were no penalties in the case, the purchasers only reserving the right of refusing the vessel in case a certain speed, considerably below the contract speed, should not be obtained; and as this minimum speed was not changed by our agent he had unwisely argued that our undertaking to give the additional half knot could make no possible difference to us. These two vessels at their official trials exceeded slightly their contract speed. The speeds given for the vessels in Table II are the means obtained over a number of hours. Natural-draught and open-stokehold speeds have usually been taken over six hours and forced-draught speeds have usually been taken over three or four hours. Curves of speed corresponding to revolutions have been constructed from data obtained by running the vessels over the Admiralty measured mile at the mouth of the Tyne, and these curves have been used in determining the speed over the four or six hours' run from the mean number of revolutions of the engines during these runs. Four consecutive runs with and against the tide have been made over the measured mile under the rules which hold for the British Navy. The Commissioners receiving the ships have taken the times of the runs and the revolutions of the engines. The times and revolutions on the runs have also been taken by my staff, the latter electrically against a time scale on a continuous sheet of paper passing over a cylinder.

In vessels from 3000 to 5000 tons displacement, a speed of about 21½ knots has been obtained with open stokeholds, and a knot or so more with forced draught. The 25 de Mayo, of 3100 tons displacement, obtained 21½ knots with open stokeholds, and 22.6 with forced draught. The 9 de Julio, of 3500 tons displacement, obtained 21½ knots with open stokeholds, and 22½ with forced draught. The Yoshino, of 4180 tons displacement, obtained 21.6 knots with open stokeholds, and 23 knots with forced draught. The Blanco Encalada, of 4560 tons displacement, obtained 21.7 knots with open stokeholds, and 22.8 knots with forced draught. Exceptionally high speed was provided in the Buenos Aires, of 4800 tons displacement; she steamed 23.2 knots with open stokeholds, but no official trial with forced draught was made.

The Piemonte, and some other vessels of less than 3000 tons displacement, have been provided with speeds lower than 21½ knots. The Piemonte herself, of 2500 tons displacement, attained a speed of 20.6 knots with open stokeholds, and 22.4 knots with forced draught.

Of the first-class cruisers given in Table III, the Esmeralda, of 7000 tons displacement, attained a speed of 23 knots with open stokeholds; the O'Higgins, of 8500 tons displacement, attained a speed of 21½ knots with open stokeholds; and the Tokiwa, of 9700 tons displacement, attained a speed of 20.9 knots with open stokeholds, and 23.1 knots with forced draught.

With reference to the manœuvring power of these vessels the resistance to turning has been reduced as much as possible, chiefly by the removal of the after deadwood, and in some cases of ships even exceptionally long and of deep draught, remarkable results have been obtained. In Table IV the diameter of the circles turned in by several of the vessels given in Tables II and III are recorded, together with the length of the ship over all, ratio of the diameter of the circle turned in to the length of the ship, and time required to turn through 180 deg. at full speed. Each of these vessels can turn in about 3½ lengths, and reverse their course in about two minutes.

We have received many reports on the steaming performances of our

TABLE I.

	Esmeralda.	Nanlwa. Takachiho.	Dogall.	Chih Yuan. Ching Yuan.
Year of launch	1883.	1885.	1885.	1886.
Length between perpendiculars	270 ft.	300 ft.	250 ft.	250 ft.
Breadth, moulded	42 ft.	46 ft.	37 ft.	38 ft.
Draught, mean	18 ft. 6 in.	18 ft. 6 in.	14 ft. 6 in.	15 ft.
Displacement in tons	2950	3727	2050	2300
Indicated horse-power with forced draught	....	....	7179	6850
Indicated horse-power with open stokeholds	6083	7120	5012	....
Speed, in knots, with forced draught	....	....	19.66	18.5
Speed, in knots, with open stokeholds	18.3	18.77	17.68	....
Armament	Two 10-in. B. L. R. guns Six 6-in. B. L. R. guns Two 6-pdr. R. F. guns Five 37 mm. Hotchkiss Two Gardners	Two 10-in. B. L. guns Six 6-in. B. L. guns Two 6-pdr. R. F. guns Ten 1-in. Nord. Four Gatlings Four torpedo tubes	Six 6-in. B. L. guns Nine 6 pdr. Hotchkiss Six Gatlings Four torpedo tubes	Three 8-in. B. L. guns Two 6-in. B. L. guns Eight 6-pdr. Hotchkiss Two 3-pdr. Hotchkiss Eight 1-pdr. Hotchkiss Six Gatlings Four torpedo tubes
Protective deck—				
Thickness on slopes	1-in.	3-in.	2-in.	4-in.
Thickness, horizontal parts	1-in.	2-in.	1-in.	2-in.
Conning tower	1-in.	2-in.	2-in.	3-in.
Coal supply, normal	400 tons	350 tons	160 tons	200 tons.
Coal supply, bunkers full	600 tons	800 tons	480 tons	520 tons.
Nationality	Chilian	Japanese	Italian	Chinese.

TABLE II.

	Piemonte.	Yoshino.	Blanco Encalada.	Buenos Aires.
Year of launch	1888.	1892.	1893.	1895.
Length between perpendiculars	300 ft.	360 ft.	370 ft.	396 ft.
Breadth, moulded	38 ft.	46 ft. 6 in.	45 ft. 9 in.	46 ft. 6 in.
Draught, mean	15 ft.	17 ft.	18 ft. 5 in.	17 ft. 11 in.
Displacement in tons	2,500	4,180	4,568	4,788
Indicated horse-power with forced draught	12,786	15,750	14,500	....
Indicated horse-power with open stokeholds	7,050	10,320	9,500	13,292
Speed, in knots, with forced draught	22.3	23.0	22.6	....
Speed, in knots, with open stokeholds	20.41	21.6	21.7	23.20
Armament	Six 6-in. Q. F. guns Six 4.7-in. Q. F. guns Ten 6-pdr. Hotchkiss Six 1-pdr. Hotchkiss Four 10 mm. Maxim Three torpedo tubes	Four 6-in. Q. F. guns Eight 4.7 in. Q. F. guns 22 3-pdr. Q. F. guns Five torpedo tubes	Two 8-in. Q. F. guns Ten 6-in. Q. F. guns Twelve 3-pdr. Q.F.guns Ten 1-pdr. Q. F. guns. Two Gatlings Five torpedo tubes	Two 8-in. Q. F. guns Four 6-in. Q. F. guns Six 4.7 in. Q. F. guos 16 3-pdr. Q. F. guns Six 1-pdr. Q. F. guns Five torpedo tubes
Protective deck—				
Thickness on slopes	3-in.	4½-in. and 3½-in.	4-in. and 3-in.	3-in.
Thickness, horizontal parts	1-in.	1¾-in.	1½-in.	1½-in.

TABLE III.

	Esmeralda.	O'Higgins.	Asama. Tokiwa.
Year of launch	1896.	1897.	1898.
Length between perpendiculars	436 ft.	412 ft.	408 ft.
Breadth, moulded	52 ft. 5 in.	62 ft. 9 in.	67 ft.
Draught, mean	20 ft. 6 in.	22 ft.	24 ft. 4 in.
Displacement in tons	7,000	8,500	9,700
Indicated horse-power with forced draught	....	....	20,550
Indicated horse-power with open stokeholds	16,020	15,930	14,718
Speed, in knots, with forced draught	....	....	23.09
Speed, in knots, with open stokeholds	23.03	21.48	20.87
Armament	Two 8-in. quick-firing guns Sixteen 6-in. " " Eight 12-pdr. " " Ten 6-pdr. " " Four Maxims Three torpedo tubes (above water)	Four 8-in. quick-firing guns Ten 6-in. " " Four 4.7-in. " " Ten 12-pdr. " " Ten 6-pdr. " " Four machine guns Three torpedo tubes (two submerged)	Four 8-in. quick-firing guns Fourteen 6-in. " " Twelve 12-pdr. " " Seven 2½-pdr. " " .... Five torpedo tubes (one forward, armored, and four submerged)
Protective deck—			
Thickness on slopes	1½ in. to 2 in. at ends	1½ in. to 3 in. at ends	2 in.
Thickness on horizontal parts	1½ in. to 2 in. at ends	1½ in. to 2 in. at ends	2 in.
Conning tower	8 in.	9 in.	14 in.
Armor—			
Belt (length)	328 ft.	260 ft.	414 ft.
Belt (width)	7 ft.	7 ft.	7 ft.
Belt (thickness)	6 in.	7 in. and 5 in.	7 in. and 3½ in.
Bulkheads	6 in.	5 in.	3½ in.
Citadel (length)	....	....	260 ft.
Citadel (thickness)	....	....	5 in.
Barbettes	....	....	6 in.
Casemates	....	6 in.	6 in.
Coal supply, normal	550 tons	550 tons	600 tons
Coal supply, bunkers full	1300 tons	1200 tons	1200 tons
Nationality	Chilian	Chilian	Japanese

TABLE IV.—*Turning Circles.*

Vessel.	L. Length of under-water body.		D Diameter of circle.	Ratio $\frac{D}{L}$.	Time to turn through 180 deg.	
	ft.	in.	ft.		min.	sec.
Yoshino	388	0	1205	3.1	1	54
Blanco	398	0	1275	3.2	2	5
Ministro Zunteno	355	0	1145	3.23	1	50
O'Higgins	446	0	1540	3.45	2	6¼
Asama	442	0	1470	3.33	2	6

ships during the past ten years, and without any exception they have been of a most encouraging and satisfactory nature. In some cases speeds exceeding those attained on trial have been reached, and long distances involving many days' steaming have been frequently traversed at full speed. One naturally looks to the stress of war for bringing to light defects in warships, but although we have learnt a great deal from recent wars, the steaming performances of the ships have always been most highly spoken of. Admiral Ito, who commanded during the recent war between Japan and China, wrote us: "In no less a degree do I recognize the important part played by the ships which were built in your yard, and I cannot here miss the opportunity of expressing to you and to my friends at Elswick my high sense of admiration for the behavior of these magnificent cruisers. Throughout this war they have never failed to fulfill our strictest expectations, and they have been of immense service to us in executing the manifold duties of a modern naval operation." With reference to Yoshino, Admiral Tsuboi, whose flag she bore during the war, has since unfortunately died, but Admiral Dewa, who was Chief Staff Officer of the Flying Squadron during the war, states that being "the fastest vessel in the fleet, and being armed with quick-firing guns and smokeless powder, she was taxed to the uttermost throughout the whole war, and performed numerous long-distance runs extending over many days at speeds of 21 knots and upwards, and the machinery never failed or gave trouble or anxiety on any occasion."

Armaments.—The Piemonte was the first ship provided with quick-firing guns, and with her powerful main armament of six 6-inch guns and six 4.7-inch guns her power of attack was at the time greater than that possessed by any other cruiser afloat, and many other vessels of twice her size. The Yoshino, 9 de Julio, and several other vessels were provided with similar armaments, while the main armaments of the 25 de Mayo, Blanco Encalada, and Buenos Aires include two 8-inch guns. The Blanco Encalada carries also ten 6-inch guns, and the Buenos Aires four 6-inch guns and six 4.7-inch guns. All of these vessels carry also a large number of smaller guns, and all carry five above-water torpedo-tubes excepting the Piemonte, which carries only three. The whole of the main armament is in each case carried on open decks, the gunners being protected only by strong shields carried on the guns themselves.

Passing to Table III, the armaments of the vessels here shown are still heavier. The Esmeralda, of 7000 tons displacement, carries two 8-inch quick-firing guns, sixteen 6-inch quick-firing guns, eight 12-pounder quick-firing guns, ten 6-pounder quick-firing guns, four Maxims, and three above-water torpedo-tubes.

The O'Higgins, of 8500 tons displacement, carries four 8-inch quick-firing guns, ten 6-inch quick-firing guns, four 4.7-inch quick-firing guns, ten 12-pounder quick-firing guns, ten 6-pounder quick-firing guns, four machine guns, two under-water broadside torpedo-tubes, and one above-water torpedo-tube.

The Asama and Tokiwa, of 9700 tons displacement, carry four 8-inch quick-firing guns, fourteen 6-inch quick-firing guns, twelve 12-pounder quick-firing guns, seven 2½-pounder quick-firing guns, four under-water broadside torpedo-tubes, and one above-water armored torpedo-tube.

The whole of the guns of the Esmeralda are carried on the upper deck, except two 6-inch guns carried upon a spar deck forward, and two 6-inch guns carried upon a spar deck aft, and four 12-pounders, two forward and two aft, on the main deck. The arrangement is such that one 8-inch gun can fire all round the bow from 45 deg. abaft the beam on one side to 45 deg. abaft the beam on the other side, and the other 8-inch gun can fire all round the stern from 45 deg. before the beam on one side to 45 deg. before the beam on the other side. All the 6-inch guns are placed on the broadside, but four of them, including the two on the spar deck forward, can fire directly ahead and 5 deg. across the bow, and four of them, including the two on the spar deck aft, can fire directly astern and 5 deg. across the stern. The gunners are protected only by gun shields carried by the guns themselves.

In the O'Higgins, the four 8-inch guns and four of the 6-inch guns are carried on the upper deck in gun-houses, which completely protect the gunners and the gun mounts, and the remaining six of the 6-inch guns are carried on the main deck in casemates. The gun-houses and casemates of the 6-inch guns have 6-inch fronts and 5-inch backs, and the gun-houses of the 8-inch guns have 7-inch fronts and 5-inch backs. Two of the 8-inch guns are placed on the middle line, one forward and one aft, with arcs of training as in the Esmeralda, the other two are placed on the broadside, with arcs of training from right ahead to some 50 deg. abaft the beam. The two aftermost 6-inch guns in gun-houses have similar arcs of training, *i. e.,* from right astern to 60 deg. before the beam. Of the 6-inch guns in casemates on the main deck two can fire directly ahead and two can fire directly astern. Two of the 4.7-inch guns are mounted on a spar deck forward; the other two are similarly mounted aft. There are thus: three 8-inch guns, two 6-inch guns and two 4.7-inch guns, besides a number of smaller guns which can fire directly ahead; and one 8-inch gun, four 6-inch guns, and two 4.7-inch guns, besides a number of smaller guns which can fire directly astern; and three 8-inch guns, six 6-inch guns, and two 4.7-inch guns, with a number of smaller guns, can fire on either broadside.

In the Asama and Tokiwa, two 8-inch guns are twin-mounted on the middle line forward in a strong gun-house of 6-inch armor, with an arc of training around the bow of from 40 deg. abaft the beam on one side to the same angle abaft the beam on the other side, and the other two 8-inch guns are similarly mounted aft. Four of the 6-inch guns are mounted on the upper deck in 6-inch armored casemates, six are mounted on the main deck, also in 6-inch armored casemates, and the remaining four are mounted on the upper deck in the open, the gunners being only protected by the gun shields. Four of the 6-inch guns can fire directly ahead and four directly astern. Thus in these vessels two 8-inch guns in pairs and four 6-inch guns can fire directly ahead, and two 8-inch guns in pairs and four 6-inch guns can fire directly astern, and the four 8-inch guns in pairs and seven 6-inch guns can fire on each broadside, besides which there are six 12-pounders and two 2½-pounders able to fire directly ahead, and similar guns able to fire directly astern, and six 12-pounders and two 2½-pounders capable of firing on either broadside.

Protection.—The thicknesses of the armored decks in the vessels given in Table II vary from 1 inch to 1¾ inches on the horizontal portions, and from 3 inches to 4½ inches on the sloping portions. In a fully-equipped condition the horizontal parts of the decks would lie from 1 foot to 18 inches above the water-line, and the sloping portions would extend to from 3 feet to 4 feet below the water-line. Most of the vessels in this class have been provided with 6-inch conning towers.

On the introduction of high explosives, and after the experiments on the resistance in penetration, it appeared to us very desirable that cruisers should be provided with side armor at least at the water-line, and the 25 de Mayo, which was then building as a stock cruiser, was altered so as to carry a belt of side armor extending from the lower edge of the sloping deck armor to 3 feet above the water-line. Her purchasers, however, elected to have her completed as originally contemplated.

In the cruisers given on Table III side armor has been provided. The Esmeralda has a 6-inch belt extending over three-quarters of her length amidships 7 feet wide, the O'Higgins has a belt over two-thirds of her length 7 feet wide and 7 inches thick, and the Asama and Tokiwa have belts over their entire length 7 feet wide and 7 inches thick, but tapered to 5 inches at the extremities. Each of these vessels is also provided with a strong protective deck from stem to stern.—*The Engineer.*

THE BLAKE.

Among the ships enumerated in an approximate summary of the shipbuilding and marine engineering work executed on the Thames within the past twenty-one years, given in our issue of December 30th, 1898, two vessels were mentioned, which it was our intention to have more fully noticed had not other pressing matter had claims on our space at the time. The vessels alluded to are H. M. first-class cruisers Blake and Blenheim, sister ships: the first-named, built at Chatham, and engined by Messrs. Maudslay, Sons & Field, of Lambeth; and the second, at Blackwall, by the Thames Ironworks and Shipbuilding Company, and engined by Messrs. Humphrys, Tennant & Co., of Deptford.

The internal arrangement and economy of a modern cruiser, though not of the very latest type, will be interesting to many of our readers not conversant with the details of ships in general, or those of warships in particular. We are glad therefore to be able to give them, through the courtesy of Messrs. Maudslay, Sons & Field, a description of H. M. S. Blake, the elder of the two sister ships before referred to; a vessel which, at the time she was designed, was the largest and most powerful unarmored cruiser ever proposed to be built for the British Navy; and to explain briefly the purposes which each of the compartments serves in the general economy of the ship. In what follows it will be understood that our descriptive matter applies equally to the Blake and Blenheim, they being built from the same lines, of the same kind of material, and fitted in every way in a similar manner.

Before entering, however, into the details of the internal arrangement of the ship, it is necessary that her principal dimensions, &c., should be stated, to enable the reader to appreciate the work which devolved upon her designer in providing within limited dimensions and displacement the necessary structural strength to make the ship an efficient fighting machine, adequate space for her propelling machinery and its adjuncts, room for the safe and proper stowage of ammunition, stores,

&c., together with sufficient accommodation for the berthing of the whole of her officers and crew.

In the early part of April, 1888, instructions were issued for preparations to be made at Chatham Dockyard for the construction of a new type of first-class cruiser, designed by the Chief Constructor of the Navy—the present Sir W. H. White, C. B.—which was to surpass in speed, coal endurance, protection and armament anything ever before attempted. The dimensions to be given to this vessel were: Length between perpendiculars, 375 feet; breadth, extreme, 65 feet; loaded displacement, 9000 tons; with a mean water draught of 25 feet 9 inches. No such ship had been added to the British Navy since the date—1861—of the Warrior. She was to be constructed of steel, without side armor; but her vital parts were to be protected by a curved steel deck extending the entire length of the ship, and she was to have propelling machinery, driving twin screws of 20,000 indicated horse-power, to enable her to attain a continuous steaming speed at sea of 18½ knots an hour, or 22 knots at full power on the measured mile.

From the foregoing particulars of requirements, readers will not be surprised to know that in length, tonnage, displacement and propelling power the Blake was 75 feet longer than any of the belted cruisers then existent, had 4000 tons more displacement than any previous vessel of her class, and her engines were fully 8000 horse-power in excess of those of a first-class battleship of her date. The tender for the construction of her machinery, by Messrs. Maudslay, Sons & Field, was accepted in August, 1888, and the vessel was launched at the end of November, 1889.

As the hull of the Blake—which is of soft steel—in its structural arrangements, calls for first notice in our brief description of the vessel, it will be seen that it is constructed on the cellular system, is double-bottomed, and is internally subdivided by a number of athwartships water-tight bulkheads. There are four principal decks, viz., upper, main, protective and lower decks. The protective deck, shown by a white line extending from end to end of the vessel, curving downward, forward and aft at the ends is of turtle-back form, and slopes down at its side edges to 6½ feet below the load water-line, while its high part on the middle line of the ship is 1½ feet above the water. On the slopes of this deck, which it will be seen is supported by deep beams for the length of the machinery and boiler space, the steel of which it is constructed is 6 inches thick, while on its flat parts the thickness is reduced to 3 inches; this protection being practically stronger than that of any then existent cruisers with similar decks, and comparing favorably with the deck protection of many foreign battleships of very much greater displacement. No side protection in the shape of thin armor was given to the ship, as it had been experimentally proved that even 4-inch armor was still penetrable by shells carrying high explosive charges.

We may at this point in our description state the armament and kind of guns the ship carries, with their disposition on board. The armament consists of two 9.2-inch 22-ton and ten 6-inch 5-ton heavy guns, with sixteen 3-pounder quick-firers, and seven machine guns. The two 22-ton guns are carried on the upper deck, one forward and one aft, to serve as bow and stern chasers, having each an arc of fire of about 240 deg. Six of the 6-inch 5-ton guns are carried on the upper deck, two of them firing right ahead, two right astern, and two on the broadsides; the midship pair firing through an arc of 120 deg., or 60 deg. before and 60 deg.

abaft the beam. The remaining four 6-inch guns are carried on the main deck, two on each broadside.

In addition to the armament above detailed, the Blake is fitted with two submerged torpedo-discharging tubes, and has her stem made with a formidable ram. As she has no external keel, it will be noted that the under-water part of her bow is gradually curved upward from the bottom, until it meets the end of the ram; and that at her after ends the deadwood, as it is called in a wooden ship, is partially cut away for some distance forward to facilitate and improve the steering and turning capabilities of the vessel. Both these features are considerably more pronounced in our latest warships. It will also not escape notice that the Blake is fitted with a balanced rudder of fairly large area, good turning power on her hull being thus ensured, without a large force being necessary to maintain the rudder in position. With her double bottom, protective deck, and the numerous bulkheads in the ship, most of which are carried up to the main deck, all made perfectly water-tight; it was considered that together they would maintain the buoyancy of the vessel should she be seriously damaged by grounding or in action. And with a view to still further protection of her most vital parts, included within the machinery space, which occupies nearly two-thirds of the length of the ship, she is shielded by coal at her sides, as well as over the slopes of her protective deck within the same length.

Internally, below the upper deck, the ship is practically divided lengthwise into four principal compartments, separated by transverse bulkheads; the first extending from inside the bows to the forward boiler-room bulkhead; the second, from this point to the forward engine-room bulkhead; the third is the space included between the forward and after engine-room bulkheads containing the propelling machinery; the fourth compartment extending from the last-named bulkhead to the extreme after part of the ship.

In reference to the first or forward main division of the ship, its lowest depths, above the water-tight platform, are principally appropriated to the small-arms magazines for the stowage of ammunition; the compartments into which this space is subdivided by transverse partitions, or bulkheads, being capable of being instantly flooded in case of fire. In the space above the magazines between the lower and protective decks, the machinery and engines for working the capstan and windlass gear are fixed, and aft of this are the shell and torpedo-rooms. Above the protective deck, and between it and the main deck, are seen the storerooms, chain cable locker, washing-room, &c., and on the main deck are shown the interiors of the forecastle, store and mess-rooms.

As the two intermediate compartments of the ship are her most vital parts, and require fuller notice, we defer description of them until we have briefly shown how the fourth, or after compartment of the ship, is appropriated.

That part of the vessel immediately adjoining the after engine-room bulkhead, below the level of the lower deck, and between it and the water-tight flat, is, in the space between the two propeller shaft passages, as far aft as the stuffing-box bulkhead, utilized as magazines; the remaining part aft of that bulkhead being used for water ballast. The sides of the shaft passages, or tunnels, in which the thrust blocks are fixed, are made to serve the purpose of storing the spare gear for the main engines. Immediately above this part of the ship on the lower deck, are the after magazines and shell-rooms, and joining these still further aft, the steering engine and tiller-rooms. On the protective deck above the magazine and shell-rooms, and near to the after engine-room bulkhead, is the engineers' workshop; the space on this deck further aft being occupied by stores. On the main deck over the engineers' workshop are the engineers' mess-room and cabins; and on the same deck further aft the executive officers' ward-room with cabins at the sides; the state-rooms of the officer in command of the ship being the farthest aft.

Directly forward of that compartment of the ship just briefly described is the one devoted entirely—below the protective deck—to the propelling machinery of the vessel. This compartment, as a whole, is divided by a middle line and two transverse bulkheads into four separate engine-rooms, each water-tight in itself, and containing a set of three inverted cylinder triple-expansion engines, so arranged that each two sets on the starboard and port sides respectively can be coupled together for driving each propeller; or, in case of damage to one set, it can be disconnected from the others, and so localize the injury sustained.

The type of engines, although favored by one foreign government, was as remarkable among previous marine engines in our own navy as the ship was among its ships, they being the most powerful hitherto applied to the propulsion of a man-of-war. The cylinders of each set were 36 inches, 52 inches and 80 inches diameter for high, intermediate and low pressures respectively, all with a piston stroke of 4 feet. Each set of engines has an air pump 33 inches diameter and 2 feet stroke; and a brass surface condenser with 2250 square feet of tube cooling surface; the cooling water is supplied by a centrifugal pump with a 3-foot 9-inch diameter impeller, driven by an independent engine, the pump being adapted to draw either from the bilge or the sea. Each two sets of engines drive an 18-foot 3-inch diameter screw propeller, having a mean pitch of 24 feet 6 inches.

The protective deck covering the engine space is dome shaped, and rises to a sufficient height above the cylinder tops to allow of their covers being removed, it being for protection at this part from 6 inches to 8 inches thick. The four engine-rooms are kept cool by air fans 4 feet 6 inches in diameter, the air being carried below by the cowl-surmounted ventilators. Above the machinery, and between the main and upper decks, the space is occupied with galley, bake-house, pantry, &c. &c.

Immediately adjoining the forward engine-rooms is the boiler, or steam-generating compartment of the ship; this, it will be seen, is bounded at either end of its length by athwartship coal bunkers, which, being connected to those at the ship's sides at this part afford great protection to its contents. This comprises six double-ended four-furnaced cylindrical return-tube boilers, and one auxiliary single-ended boiler. The double-ended boilers, designed for a working pressure of 150 pounds per square inch, are each 15 feet 2 inches diameter and 18 feet long; placed side by side, and fired fore and aft; the auxiliary boiler for supplying steam to all the auxiliary engines in the ship—about sixty in number—being 10 feet diameter and 9 feet long; the total heating surface in the main boilers being nearly 27,000 square feet, with 863 square feet of fire-grate; the heating surface in the auxiliary boiler being 900 square feet.

Each set of three main boilers, it will be noticed, is in separate boiler-rooms, divided from each other by transverse bulkheads; the small boiler being located between these. The products of combustion are carried off from each triplet of boilers by one funnel, that from the small boiler being led into the uptake of the after set, ample air being supplied to the stokeholds by the cowl-mounted ventilators; the ventilator shafts serving also for conveying the waste ashes to the upper deck by means of the ash hoists fitted to them. For the attainment of high speed for which the ship was designed, the main boilers are fitted for the application of forced draught to the furnaces with closed stokeholds, twelve fans, 5 feet 6 inches diameter, driven by independent engines, being supplied for that purpose. The coal bunker capacity of the ship is 1500 tons—one-sixth of her load displacement—sufficient to enable her to cover a distance of 15,000 knots at a ten-knot speed.

Having briefly described the internal arrangement of the Blake below decks, we have now to note the few erections, &c., to be found upon her upper deck, and the appliances for handling the boats, &c., carried by the ship. With the exception of the slightly raised forecastle deck forward, the upper deck of the ship is flush from end to end. Upon it, at what is known as the "break of the forecastle," the most important erection is the "conning tower," having above it the upper and lower forward bridges. This tower, which has its foundation below on the protective deck, though not a large, is a massive structure, usually circular in form, made of rolled steel plate, some 12 inches thick, above the upper deck, diminishing in thickness towards its base. From this tower is seen all that is taking place on deck and around the ship when in action; and it contains within it all the necessary means of communication with the different stations in the vessel for controlling her when under fire. On the lower bridge, directly over the conning tower are the bridge telegraph, the binnacle, wheel and chart houses. The ship has two steel pole masts with flag topmasts, but no sail power, with the exception of a fore stay-sail for steadying purposes. Both masts are fitted with derricks, the after one being a substantial spar used for hoisting in and out, the steam vedette boat and pinnace carried in chocks on the deck.

A flying gangway connects the forward and after bridges, the latter having on it a chart house with signal flag lockers, &c. Directly aft of this bridge is a small director tower, with sighting holes for torpedo-firing purposes. The only other erections on deck, though not fixed ones, are the armored shields for the two big guns, these being semi-circular in form with sloping roofs; the guns being on the central pivot system. The shields move with them when being trained. In addition to the two large boats carried inboard, the Blake has ten others, carried in davits along her sides. Electricity supplies light throughout the ship, it being generated by three Siemens dynamos, driven by a Willans engine, each capable of producing a current of 400 ampères.

Although the power developed by the Blake's engines on the forced-draught trial did not quite come up to that contracted for, that given out by them under natural draught exceeded the contract—14,000—by as much as 1525 indicated horse-power, with less than the Admiralty limit—½ inch—of air pressure. On the mile, the speed realized by the ship was less than was anticipated in proportion to the power developed by the engines, but with the actual air pressure used on the natural draught trial—.42 inch—the boilers worked remarkably well.—*The Engineer.*

THE LAUNCH OF THE KAISER WILHELM DER GROSSE.

This vessel is one of the group of three great turret ships building for Germany, namely, the Kaiser Friedrich III, Kaiser Wilhelm der Grosse, and the König Wilhelm (Ersatz). The table herewith shows the dimensions and principal data of the vessel in question. The thicknesses of the belt and turret armor, however, have been slightly altered in accordance with information received from Germany. It will be seen that the vessel is an extremely formidable first-rate line-of-battle ship. The special features are great speed and energy of fire. In our judgment her protection is open to objection. At the same time only actual trial would test this. Her belt of 12-inch Krupp armor is abundantly strong, and with her curved deck protects her vital parts beneath thoroughly well. The upper structure has, however, very little protection beyond the actual gun positions, and could be riddled with common shell. The German contractors have accepted this liability no doubt, making provision against serious fire by the removal of all wood. It would be interesting to see what common shell would effect. We question if the structure supporting the gun positions would not become injured and distorted by shell bursting beneath them, but to this the contractors no doubt have some reply. About the 18 knots speed there can be no two opinions. It agrees with what we have laid down for our largest 15,000-ton battleships, that is, the Bulwark, Implacable, Irresistible and London. The energy of fire is nearly as great as that laid down for any ship, that is, about 577,000 foot-tons per minute, or 53 foot-tons per ton displacement.

The first ship of this class completed was the Kaiser Friedrich III, which when tested at Wilhelmshaven on October 30th last easily made her 18 knots stipulated speed, with 13,500 indicated horse-power and 115 revolutions, although in a heavy sea and strong wind. The grouping of the guns and disposition of the armor are half French and half British. The belt is complete, and, as above said, the price is paid for it in absence of protection to the upper part of the hull. This, and the small single turret gun position on the broadside, are French. On the other hand, the curved deck and large double-gun turrets were originally British features, and some of the 15-centimeter quick-firing guns are in positions closely resembling Sir W. White's casemates. It is interesting to watch in the various designs of battleships the great uncertainty as to whether to adopt what we may term the French or British grouping. The French and British designers hold firmly to their own systems. No British ship can be found with her guns grouped in any sense like the French; we may look through our designs in vain for the little single-turret mountings. No French ship has anything like our casemates. This distinctive line is rarely found in other navies. Russia was apt to surround her secondary armament with a single-armored wall, with a marked absence of steel traverses and divisions, but in the Poltava class the heavy quick-firing guns are in small double turrets. The newer Japanese designs are distinctly British, except that in the Mikasa, building at Barrow, of 15,200 tons displacement, the largest battleship in the world, the quick-firing gun casements have no intervals between them, thus forming a continuous wall, for which, we think, there is much to be said. The United States armaments have been grouped rather on the French system, while the armor, forming a belt of limited length in combination with horizontal armor at the ends and the side plates over the belt, is British. Germany has followed France in the complete water-line belt and grouping of armament generally, although in this class we now see some approach to the British casemate and the curved deck.

Finally, we may remark that the Kaiser Friedrich der Grosse class marks the existence in service of the Krupp thick armor, which has given the remarkable results that have caused the adoption of this armor in all important navies. It was with this class of plate that Krupp obtained the record figure of merit of 2.33; that is to say, a resistance equal to that of 2.33 times the plates' thickness in wrought iron; so that this ship's 12-inch, or possibly 11.8-inch of Krupp steel may be equivalent to about 28-inch or 27.5-inch of iron. As our readers are aware, the German Navy is likely to be increasingly furnished by Krupp.

KAISER WILHELM DER GROSSE, GERMAN FIRST-CLASS BATTLESHIP.

Length	377 ft.
Beam	67 ft.
Draught	26 ft.
Displacement	10,955 tons.
Motive power	13,000 H. P.
Speed	18 knots.
Coal supply	640 tons.

Armament—

4 24 cm. (10-in.)	Quick-firing guns.
18 15 cm. (6-in.)	Quick-firing guns.
12 8.8 cm. ($3\frac{5}{16}$-in.)	Quick-firing guns.
12 3.7 cm. ($1\frac{15}{32}$-in.)	Quick-firing guns.
8 0.8 cm. ($\frac{5}{16}$-in.)	Machine guns.

Torpedo armament—

1 under-water bow tube	53 cm. (21-in.)
4 " broadside tubes	46 cm. (18-in.)
1 above-water stern tube	46 cm. (18-in.)

Armor—

Belt	12-in.
Curved armor deck	3-in.

MERCHANT STEAMERS AND WAR REQUIREMENTS.

*On the Practicability of so Constructing Merchant Steamers as to Render them Readily Available for War Purposes.**

By JOHN HARVARD BILES, M. Inst. C. E.

The two purposes for which merchant steamers may be used by the navy in time of war are: (1) armed cruisers; (2) auxiliaries for supplying a fleet with necessaries and as troop transports.

For the former purpose they may have to fight cruisers; for the latter, they will frequently require protection from either armed mercantile cruisers or regular warships, but their ability to do the duty is undoubted, and need not be discussed.

Obviously as armed cruisers vessels must have considerable speed, and their numbers are in consequence limited. Lloyd's gives the following:

* Paper read before the Engineering Conference of the Institution of Civil Engineers. Section V, Shipbuilding.

20 knots and upwards		43
19 " "		35
18 " "		48
17 " "		83
16 " "		77
15 " "		128

Slower vessels will probably not be used as armed cruisers. Those speeds appear to be in most cases sea speeds. Some of the larger vessels have coal-bunker capacity, exclusive of holds, sufficient to enable them to steam for from 10,000 to 12,000 knots at 10 knots speed.

We may reasonably assume that vessels of this character are better able to maintain their speed at sea than warships. Their every-day business is to run at some speed called full speed, and most of them do not run at any other speed. It does not follow that they cannot steam easily at lower speeds, but a ship which ordinarily does not steam at full speed is more likely to fall short of maintaining full speed over long periods than one which is in the habit of doing it.*

In consequence, merchant ships have been considered to be most suitably used as scouts or despatch boats, and no attempt has been made to give them an armament equivalent to warships of anything like their size, power, and speed. Some of the results or arming and fighting the mercantile cruisers of the United States Navy seem to point to the ability of these vessels to cope with thoroughbred warships.

One point is deserving of consideration. Is there not a considerable value in a floating structure, whether it is subdivided and protected as a warship, or has no more subdivision nor protection than a tramp? It floats, and it offers considerable resistance to sinking, whatever kind of ship it is. Does not the result of modern sea-fighting point to the conclusion that a ship is more likely to be disabled by her crew being driven from their guns than from her being sunk from the effects of shell fire? If this is so, the extra subdivision and protection of buoyancy and stability of a warship over a merchant ship may not be called into play, and the fight between the two will become one of guns *versus* protection of gunners. This leads to the consideration of the question of portable protection for gunners in the merchant ship.

In the first-class cruisers, casemates are built into the ships. These would be impracticable in a merchant ship. But guns with shields are portable enough, and would place a merchant ship in a very favorable position compared with a second-class cruiser, as her size and deck area allow her to mount a much larger number of guns. In a paper which I read in 1894 before the Institution of Naval Architects, I endeavored to show how large mail steamers could be made as fit to fight as many first-class cruisers. Portable side armor was proposed, which should be ready for bolting on in time of war. If this system were adopted for the protection of guns, by placing them in a box battery, as the Americans have done and the Japanese are doing in the ship Mr. Dunn has designed for them at Barrow, a considerable number of guns could be mounted, which could be as well protected as in first-class cruisers. This subject is, however, too detailed to be discussed here, but it is not an impracticable operation to have portable armor put on a mail steamer.

*In the recent Spanish-American war the cruisers St. Louis and St. Paul, New York and Paris, could steam at 4 knots with the main throttle shut by the use of the exhaust steam of the auxiliary engines only. About thirty tons per day is the necessary consumption on auxiliaries, and the exhaust steam was sufficient to propel the ship at 4 knots and keep the machinery ready for immediate increase of speed to 20 knots. Eight minutes is the time given by the engineers as sufficient to make this change.

The work done by the American line steamers in the recent war included scouting, drawing the fire of forts to discover their strength, cable-cutting, troop, coal, and water-carrying. All this work can be done by any vessels of high speed and large coal endurance, but it is worth discussing whether, having employed vessels valued at £100,000 to £500,000 each to do this work, it is not desirable to go a little further and make them able to do more by arming and protecting them so that they can meet second-class cruisers with the chances in their favor, and with a fair chance of holding their own against a first-class cruiser. If they can, then the number of cruisers which will be available to protect our commercial routes may be much increased, and we shall not be taking up merchant ships because their speed will enable them to successfully run away from the cruisers of an enemy who are destroying their slower sisters.

The practicability of designing merchant steamers so as to be readily adapted for war purposes has been discussed in the Institution of Naval Architects. The desirability is always a subject for discussion.

The experience of recent wars points to the desirability of having vessels which can carry large coal and store cargoes, and which have facilities for readily transferring these cargoes to warships at sea. This work could be well done by some of the large freight carriers of lines which carry mails. Special appliances would have to be fitted to these vessels, which might or might not carry these appliances in their regular work. In the construction of these vessels special consideration might be given to their use for such purposes. Some large freight carriers have ocean speeds of 15 knots, and such vessels would be of great service in time of war.

A question arises in connection with the special and ordinary types of merchant vessels as to their strength to carry guns. These vessels are generally constructed of scantlings much thicker than those of warships, and many places in their decks are amply strong enough to carry guns. Possibly some parts would require special strengthening, but this could be readily applied if necessary.

In the matter of position of machinery in relation to the water-line, the later vessels of moderate and large size have their machinery and boilers not far, if anything, above the water-line. With a little consideration to the question in the early stages of design and construction it is easy to arrange the structure so that the coal which these vessels carry will give protection. Twin-screw engines and increased revolutions are tending to make merchant ships more safe in this respect.

The principal point to note in connection with merchant ships for war purposes is, that a ship of any kind offers considerable resistance to the destruction of its buoyancy and stability, and, in consequence, with guns and gunners sufficient and sufficiently protected, the merchant ship need not be much, if any, inferior to many warships.—*Engineering*.

THE NEW BRITISH BATTLESHIP VENGEANCE.

H. M. S. Vengeance, to be launched on Tuesday by Messrs. Vickers, Sons, and Maxim, Limited, Barrow-in-Furness, is a first-class battleship laid down on August 23, 1897, and to complete next spring at a cost of £870,419, according to the Navy Estimates. There is no doubt about this time result being realized, as the vessel is much further advanced than is usually the case with vessels to be launched into the water on ways. She is 390 feet long between perpendiculars, 74 feet beam, and some concessions have been made in her design to insure a draught of only 26 feet when she is in full working order. The displacement then will be 12,950 tons, of which 8550 tons are due to the hull. She may be said to belong to the Canopus class, although having been ordered a year later, she embodies several changes in detail. Like the five vessels of the type named, her side armor is of 6-inch thickness instead of 9-inch; but, the face being specially hardened, the shot-resisting power will be greater than that nominally corresponding to the thickness. The broadside armor is 14 feet deep, being carried 5 feet below the load-water line. The length is about 196 feet, leaving about 100 feet forward and aft, but this is more nominal than real, for instead of the thwartship bulkhead being, as has hitherto been general, at right angles to the line of the ship, the end armor is arranged in the form of a >, the point being towards bow and stern, and as this is from 12 inches to 8 inches thick, thinning towards the bottom, it extends the armor protection. Again, the side armor is carried to the ram as 2-inch nickel-steel plating, which broadens as it extends forward till it reaches from top to bottom, and thus the ram is greatly reinforced. Here it may be said also that the forefoot is greatly cut away, as is also the deadwood aft to improve the circle turning of the ship. Abaft the citadel the side plating is made thicker at the load line for a depth of quite 10 feet. The protective deck is 2 inches thick, and as usual, is curved from the bottom of the side armor to above the water-line in the center. This curve enables the engines to be entirely below the deck, obviating the necessity for an armored coaming round the cylinders. There is the usual bunker protection, and coal is carried both under and upon the protective deck, the other levels within the length of the citadel being middle, main, upper, and boat decks. The last-named, however, does not extend the full width of the ship. At the end of the ship there is a platform below the protective deck.

The barbettes for the pairs of 12-inch guns are immediately within the > at the forward and after end of the citadel. These are 36 feet 8 inches in diameter, of 12-inch Harveyed nickel steel. There are four casemates on the main deck on each broadside, there being twelve 6-inch quick-firing guns in all, four of them being placed on the upper deck. The bow and stern quick-firing guns have a range to 28 degrees abaft or forward respectively, and the broadside guns the usual 120 degrees. The casemates are in plan very irregular octagons, the end ones being almost triangular. There are, in addition, eighteen smaller guns, three 12-pounders in the citadel on each broadside on the upper deck, and four on the main deck, two firing forward and two aft. The machine guns are on the bridges and military tops. The masts are very lofty, and carry searchlights, which are placed on a platform well raised. There are two navigating bridges, one forward and one aft, and two conning towers, the forward one having 12-inch Harveyed nickel steel, and the after 3-inch nickel steel. The voice tube and ammunition hoists are armored.

The Vengeance is, of course, propelled by twin screws, each driven by an independent set of triple-expansion engines, with three vertical cylinders of the collective power of 6750 indicated horse-power, the aggregate being 13,500. This is attained with the engines making 108 revolutions, and with a steam boiler pressure of 300 pounds per square inch, reduced to 250 at the engines, and at this point it may be said that the total weight of the machinery, main and auxiliary, including boilers and the water in them, is about 1290 tons. The high-pressure cylinder is 30 inches in diameter, the intermediate-pressure 49 inches, and the low-pressure 80 inches, the stroke being 51 inches. The cylinders are separate and independent castings, stayed together, and all the barrels are jacketed. The high-pressure and intermediate-pressure cylinders are each fitted with one valve of the piston type, and the low-pressure cylinder with the ordinary flat valve fitted with equilibrium rings. The valve gear is the double eccentric ordinary link motion. The straps are separate from the rods, and of forged steel, lined with white metal. Double-cylinder reversing engines are fitted, which in 30 revolutions turn the main engines from full gear ahead to full gear astern. The starting position, it may be added, is amidships.

The bottom frames of the engine are of cast steel, and are bolted together to form one complete bed-plate for each set of engines. Bolts, and not studs, are used for securing the main bearing caps. The front columns are forged steel, and the back columns are of cast iron with guides bolted to them.

The pistons are of cast steel of conical form, the piston-rods of solid wrought steel 8¼ inches in diameter, with a substantial collar under the piston. Ample surface is provided for the ahead and astern guides. The connecting-rods are 8 feet 6 inches long, center to center. The crank and propeller shafts are of forged steel, finished complete at the company's works at Sheffield. The couplings are forged solid with the shaft, except the wrought-iron disconnecting coupling. The total length of the shaft from the main engine to the propellers is about 124 feet. The crankshaft is made in three interchangeable parts, the external diameter being 16½ inches, with a 9-inch hole. The length of the main bearings is 9 feet 6 inches. The crank-pins are 18 inches in diameter outside and 9½ inches inside, and 20 inches long. The cranks are set at an angle of 120 degrees. The sequence is high pressure, low pressure and intermediate pressure, the high-pressure cylinder being placed at the forward end and the low-pressure aft. The propeller shafting between the crankshaft and the stern tube is 15½ inches outside and 8¾ inches inside diameter. The stern shaft for the stern tubes is 16½ inches outside, exclusive of the gun-metal casing, and 9 inches inside. The shafting beyond the stern tube is 17½ inches outside and 10 inches inside. The after coupling of the propeller shafting is so arranged that the after length of shafting can be withdrawn in a forward direction without disturbing the stern-tube shaft. The shafting within the tube is effectively cased with gun-metal. The thrust-block consists of horseshoe collars faced with white metal having a thrust surface of 1800 square inches for each set of engines. The stern tubes are of gun-metal, cast in one length, fitted with lignum vitæ bearings in the usual Admiralty manner. The propellers are four-bladed, of bronze, and 17 feet in diameter, and work inwards. The turning engines with two cylinders are capable of turning the main engines completely round in eight minutes with two-thirds the working pressure of the boilers, and when exhausting into the atmosphere. Hand-turning gear is also provided.

The condensers are circular, made of rolled naval brass plates with gun-metal mountings. One main and one auxiliary condenser are placed in each engine-room. The total cooling surface of the two main condensers is 14,500 square feet, and of the auxiliary condensers 2200 square feet. These latter are used for condensing the steam from the auxiliary engines throughout the ship, and are fitted with a combined circulating and air pump. The condenser tubes are of solid-drawn brass, untinned, $\frac{5}{8}$ inch in external diameter and .048 inch thick. The pitch of the tubes is $\frac{31}{32}$ inch. One main air pump is fitted to each main engine, 30 inches in diameter by 19 inches stroke, and is driven by means of levers from the low-pressure cylinder crosshead. These pumps deliver into a hotwell. Two circulating-pump engines are fitted to each engine-room. They are of the centrifugal type, having impellers 45 inches in diameter, driven by a compound engine. The duty expected of these pumps is 1200 tons of water from the bilge per hour with two-thirds the steam pressure, and exhausting into the atmosphere. Either of the two sets in each engine-room is large enough for the duty. The circulating sea-suction pipes are 17 inches in diameter and the discharge 19 inches. These engines are placed as high practicable in the engine-rooms. The hotwell is of 100 cubic feet capacity and is fitted low down in each engine-room. The main air pumps deliver into these hotwells. A pumping engine of the duplex type is fitted to draw from these hotwells and discharge through grease extractor tanks into the feed tanks. These pumps are also connected to the main condensers. Each grease extractor has over 10,500 square inches effective filtering surface, and the extractors are easily cleaned. Tanks for feed water of about 70 tons capacity are provided in wings and double bottoms. These tanks can be filled by means of injectors at the rate of 50 tons per hour. Means are provided for the admixture of lime with the feed water. The feed pumps (by Messrs. Weir), six in number, are fitted in the boiler-rooms; one in each compartment is arranged as a main and one as an auxiliary feed pump. They are of such a capacity that three are sufficient for the full power. The pressure in the feed pipes arranged for is 700 pounds per square inch.

The main steam pipes are of steel, lap-welded with butt-strap over the weld for pipes down to, but not including, 6 inches. Below this they are solid-drawn steel down to $1\frac{1}{2}$ inches in diameter; below this again they are of solid-drawn copper. Reducing valves are fitted in the main steam pipe in each engine-room between the main shut-off valve and the regulating valve. Separators are fitted in the engine-room, one each side, on the boiler side of self-closing valves.

There are twenty boilers of the Belleville type, with economizers, and all recent improvements. Each boiler can be used independently of the others, and works at 300 pounds per square inch. The boilers are arranged in three compartments, eight in each of the forward and middle boiler-rooms, and four in the after. There is no middle-line bulkhead in the boiler-rooms. Fifteen of the boilers have nine elements of large tubes $4\frac{1}{2}$ inches in external diameter, and five boilers consist of eight elements of large tubes $4\frac{1}{2}$ inches in external diameter, each element containing seven pairs of tubes. All the boilers are fitted with economizers, those in the wings of the ship having six elements, and the remainder seven elements in each case. The economizer elements consist of ten pairs of tubes $2\frac{3}{4}$ inches in external diameter. The heating surface is 21,760 square feet in the main tubes, and 12,010 square feet in the economizers, the total being 33,770 square feet. The boiler tubes are all of British manufacture, as also the material from which they are drawn. The tubes are all solid-drawn, finished cold, carefully annealed after manufacture, and subjected to severe tests. Each tube is coated externally with zinc by electro-deposition at the Barrow Works.

As to the auxiliary engines in the ship, some brief reference may be made. The distilling machinery, by Messrs. Weir, consists of two evaporators capable of evaporating from sea water 68 tons per 24 hours when worked not compound, and 42 tons when worked compound. The two distillers produce 40 tons of fresh aërated water per day, for drinking, at 15 deg. Fahr. above that of the circulating water, with circulating water at not less than 75 deg. Fahr. The electric-light machinery consists of three sets of combined engines and dynamos, the electromotive force being 80 volts for all loads from 10 up to 600 ampères.—*Engineering.*

The commerce-destroyer Jeanne d'Arc, launched on Thursday, June 8th, is in some ways the most important vessel ever constructed for the French Navy. This importance is not confined to the ship itself; it represents a new *motif*, and a *motif* specially considered in connection with this country. At the time that she was laid down the references in some French newspapers to Joan of Arc, and the ignominious defeats that the Maid of Orleans inflicted upon the English, were not called forth merely by the name. Jeanne d'Arc is no new name in the French Navy List. What a good many sanguine Frenchmen look for, or did look for, was that the Jeanne d'Arc would form a type of vessel before which *perfide* Albion would have to go down. In other words, the Jeanne d'Arc is the pioneer of a type intended not merely to be able to destroy our commerce—which a Guichen or Château-Renault could do equally well—but to be able to chase from the seas our Powerfuls and Diadems. Too swift to be caught by battleships, the dream embodied in the Jeanne d'Arc seemed sufficiently real and possible to our Admiralty to lead to the laying down of a good many Cressys and "mighty cruisers." Certainly, on paper, the Jeanne d'Arc looks infinitely better all round than our Powerfuls and Diadems.

The following are the "fighting qualities" of the three types. Many of our readers must by now be familiar with the "War Game" notations of guns and armor, which we have before now utilized for rapid comparisons. We introduce them here:

——	Terrible.	Jeanne d'Arc.	Diadem.
Tonnage	14,200	11,270	11,000
Complement	894	626	677
Guns 1°	two 9.2-inch (B)	two 194 mm. 7.6-inch (C)	nil
Q. F. 2°	twelve 6-inch (D) sixteen 3-inch (12-pounders)	fourteen 5.5-in. (D)	sixteen 6-in. (D) twelve 3-in. (F) (12-pounders)
Q. F. 3°	twelve 3-pounders	sixteen 3-pndrs. eight 1-pndr.	twelve 3-pndrs.
Armor:			
On 1° guns	6-inch (C)	6-inch (C)	——
On 2° guns	6-inch (*c*)	6-inch (C)	4½-inch (c *d*)
Water-line	nil	6-inch (c)	nil
Lower-deck	nil	3-inch (Σ)	nil
Slopes of armor deck in inches, 6 inches equivalent to a protection of	= *a a*	3-inch (c)	= *b*
Protection to vitals	= *a a*	= *a a*	= *b*
H. P. (maximum)	25,000	28,500 (estimated)	18,000
Speed (maximum), knots	22	23 (estimated)	20.8
Screws	2	3	2
Coal (normal), tons	1,500	1,400+petroleum	1,000
Bunker capacity, tons	3,000	2,000+petroleum	2,000

Now from this it is evident that the armored water-line and extra speed are the Jeanne d'Arc's *pro's*, while the lack of 3-inch guns makes her armament completely inferior. Before, however, proceeding to carry the comparison further, we will give further details of the French cruiser.

The water-line belt is complete. Probably it will, like French belts generally, be completely under water; indeed, by design it is practically that. Above it, however, the lower deck is protected by 3-inch armor of a resisting value equivalent to the coal bunkers on the Powerful's lower deck. Probably there are bunkers behind that might be full; but as the ship will carry only 1400 tons normally, while the Powerful normally stows nearer 3000 than her nominal 2000, the Powerful has a superior coal protection. Now the 3-inch armor of the Jeanne d'Arc is not thick enough to keep out our 6-inch Lyddite shell, consequently, save for hits at a wide angle, is of little more utility than the unarmored side of the Powerful, and trusting, as this ship does, to her coal bunkers, it is not impossible that her water-line will prove in practice quite as safe as the Jeanne d'Arc's.

The protective deck of the Powerful being thicker, it will be noted that her vitals are as safe as those of the Jeanne d'Arc. So, so far as the Jeanne d'Arc is concerned, are those of the Diadem; the 8-inch guns could never penetrate the Diadem's deck, except possibly at the muzzle. The weak point in the Diadem and the Powerful, the ability of 3-inch guns to destroy their water-lines, the Jeanne d'Arc is not provided to cope with. The entire bow of the Jeanne d'Arc is covered with 3-inch armor, some protection to the base of the forward 7.6-inch guns, but again too thin to keep out shell, except at very long range and at an acute angle. She would have to fight at long range to avail herself of it, and then the absolutely unprotected bases of her 6-inch guns would give trouble. The Powerful has casemates or bunkers under her 6-inch guns, and being a heavier ship with less armor to carry, she is presumably of stouter construction to withstand shell under the guns.

As originally designed, it was intended to give the Jeanne d'Arc eight instead of fourteen 5.5-inch guns (13.8-centimeter) and twelve 3.9-inch guns. These twelve would have been carried where the six upper-deck 5.5-inch pieces now are, that is to say, eight in caves about the forward group of funnels, and four aft in gun-houses of a kind. It was concluded that these 3.9-inch pieces would be of little use, so every other one was knocked out and 5.5-inch guns substituted. This had the additional advantage of simplifying the armament, an important thing, seeing that how to supply the guns has been a tremendous problem, even with the simpler armament.

The fact is that the 23 knots of the Jeanne d'Arc have to be paid for, and paid for heavily. The whole of the ship between the masts is occupied with engines and boilers. The French take some pride in themselves over the ingenious way in which, despite the huge space taken by the engines, they have been able to work in magazines below them, and run the ammunition hoists up through boiler-room and machinery. If is a triumph—of a sort; but though ammunition hoists passing close to furnaces, and kept at a temperature of 40° or 50° by means of refrigerators inside them may be exceedingly ingenious, and may work all right, their existence is not likely to assist the engine-room department in maintaining that coolness of temperament which will be necessary to ensure the 23 knots.

Taking her all in all, the Jeanne d'Arc is an ingenious vessel—too ingenious. Despite all that has been written by partially-informed critics, we feel certain that in war-time she would be no match for the Powerful; and in action with the splendidly simple Diadem would by no means be a certain winner. Personally we should feel happier in the Diadem. In energy of fire, on paper, the Jeanne d'Arc has, we know, a better broadside, while her end-on fire, again mightily ingenious, is ten 5.5-inch and one 7.6-inch, against six 6-inch, on paper. On the beam or quarter there are positions in which she could bring four, or even six, 5.5-inch guns and one 7.6-inch against the Diadem's three, or say four 6-inch. But the difficulties of securing such a position, and the still greater one of maintaining it, practically put it out of court. Her armored area throws that of the Diadem into complete insignificance. But, as we have shown, the value of her armor is very slight, and it stands to reason that on the same displacement of the Diadem a cruiser cannot have all this armor and extra H. P. without heavy sacrifices elsewhere. Battles are fought at sea, not on paper.

We would not go quite so far as to characterize the Jeanne d'Arc as a "fraud," but she is not far from it, and certainly will never sweep our cruisers from the sea. We have purposely compared her to the Powerful and Diadem rather than the new cruisers, because those are the ships she was designed to compete with. As to our new cruisers, the Cressys and Drakes, there is no comparison possible. These are practically Powerfuls with sides armored better than those of the Jeanne d'Arc, and —important point—with the bases of the gun positions unassailable by shell. As to speed, the Jeanne d'Arc's 23 knots mean nothing as yet. No "maximum speed" could be kept up at sea, if even it could be reached. The question is, What is the highest constant speed she will be capable of, and for how many hours? Modern French battleships are swifter than those we have in commission, but their coal will not allow of more than a comparatively few hours' steaming at it; hence much of its value is lost. Carrying liquid fuel in addition to her 1400 tons of coal, the Jeanne d'Arc may be better off than many ships in this respect, but this question cannot be profitably discussed till she has been on trials, and we are not sufficiently acquainted with her lines to know whether, like British cruisers, she can fill her bunkers to the maximum capacity and yet lose next to no speed in consequence.

To return to the discussion of the Jeanne d'Arc's details. She is 477 feet long, 63⅔ feet broad, and will draw 26½ feet of water. The engines will be three sets of vertical triple-expansion, each set actuating a screw. Steam will be supplied by forty-eight Du Temple boilers, as at present decided, but possibly some other boiler may be substituted; there is very strong agitation in France in favor of the Niclausse.

The form of funnels, or rather, forms adopted for the Jeanne d'Arc, is worthy of remark. The casing of the after group is to be kept low "in order to assist stability." Here, again, is an exhibition of ingenuity that, had the ship been one of ours, we should not regard the need of—if it is a case of necessity, or anything approaching necessity—with particularly pleasant feelings. There seems too much "wonderful balancing feat" about it.

The Jeanne d'Arc, in fine, is likely to prove a Great Eastern—more wonderful than useful.

It is a French custom to give various decorations after the launch of a ship of war. After the launch of the Jeanne d'Arc one officer decoration and three chevalier decorations of the Legion of Honor, and five *médailles militaires* were conferred on those concerned.—*Royal United Service Institution.*

In the English naval manœuvres the torpedo-boat destroyer flotilla will consist of the 24 torpedo-boat destroyers, forming the instructional flotillas attached to the various home ports, with the four destroyers, specially commissioned; they are to have a week's preliminary training in evolutions under the command of Captain Durnford of the Vernon torpedo-school at Portsmouth, who will hoist his commodore's pennant on the torpedo-gunboat Jaseur. The torpedo-boat flotilla will have assembled at Plymouth and are to rendezvous at Belfast on the 22d inst., where they will join the squadron under the command of Vice-Admiral Sir H. Rawson. As usual, the port-guard and first reserve ships have been brought up to their sea-strength, the latter with the Howe and Thunderer, being completed by coast-guard men.

By Admiralty order only signalmen who have had seagoing experience have been sent to torpedo-gunboats, torpedo-boat destroyers, and torpedo-boats for the manœuvres, and at least two-thirds of the engine-room ratings of torpedo-boat destroyers specially commissioned for the manœuvres were to consist of men who have undergone instruction in these boats. If necessary, supernumeraries (with the exception of the Royal Naval Reserve men borne for training) were to be discharged from the Channel Squadron ships to make up to seagoing strength the complements of specially commissioned ships. The Juno has been specially fitted for experimenting with Marconi's system of wireless telegraphy.

It is stated that during the manœuvres experiments with carrier pigeons will be tried on a much more extensive scale than has hitherto been attempted in the British Navy. The birds have all been trained under expert supervision, and will have their headquarters on one of the torpedo-gunboats, which is to be specially commissioned, and will be under the charge of an experienced naval officer.

The Manœuvres.—The Admiralty have officially defined the object of the naval manœuvres this year to be as follows:

1. The principal object of the 1899 manœuvres is to obtain information as to the most advantageous method of employing a considerable body of cruisers in conjunction with a fleet.

2. The subsidiary object is to throw some light on the relative advantages and disadvantages of speed and fighting strength.

3. Another subsidiary object is to obtain information relative to the working of destroyers and torpedo-boats.—*Royal United Service Institution.*

LORD BRASSEY ON THE BRITISH NAVY.

The address delivered by Lord Brassey, the Governor of Victoria, to the Melbourne Chamber of Commerce, is an exhaustive summary of the present condition of the British Navy.

The estimates of the current year amounted for the French Navy in round figures to $62,500,000; for the Russian, to $43,500,000, and for the British to $132,970,000, which last was an increase of $15,000,000 on the previous year. The shipbuilding vote alone reached the enormous figure of $64,085,000, an increase upon last year of $10,080,000. It is the announced policy of Great Britain to make her navy equal in strength to the navies of any other two powers combined, and certainly she does so this year, in new construction, with a liberal margin. She builds more cheaply, too, than France and Russia.

But Lord Brassey holds that the British Empire can afford this naval increase. He quotes Sir Robert Giffen to show that the Empire's combined revenues are $1,490,000,000, an increase of $575,715,000 since 1871, or more than 40 per cent. of the present total. Its exports and imports aggregate $6,875,000,000, an increase since 1871 of $2,140,000,000, or about one-third of the present total. On the other hand the national debt, which was $3,845,000,000 in 1875, had been reduced last year to $3,375,000,000, while private wealth has increased. In contrast we have a great increase of the Russian debt in the last twelve years.

While France has a permanent naval force of 42,000 men, and Russia one of 35,000, the proposed British strength for the current year is 110,640, showing an increase of 4250. No fewer than 27,000 men have been added in the last five years. But Lord Brassey shows anxiety over getting men for the reserve, and says that the resources for recruiting from blue-water seamen are diminishing. Steam and the Suez Canal have brought up the foreigners to 40 per cent. of the total crews of British ships.

At the end of this year England will have forty-six battleships completed of the first and second class, the oldest scarcely ten years in commission; while France has thirty-three, and Russia eighteen. Of the British ships twenty-three will be of the first class, as against eighteen of the other two powers. And in average size the British ships are especially superior. Under construction England has sixteen battleships, "more than any three other powers combined." The latest ships, those of the Canopus and Duncan types, displace 14,000 tons, or about 1000 less than the Majestic and Irresistible. The biggest ships gain in sea-keeping qualities, steadiness of gun platform, armament, protection and coal endurance, but their deep draught keeps them out of many good harbors. In view of what is claimed for the French coast defenders, with two heavy guns in single turrets, and with light draught and facility in turning, Lord Brassey thinks the British answer to these should consist in part of ships especially adapted to narrow waters, where protection and number of rams and guns are more important than steadiness of platform in heavy seas, or than coal endurance. In general he notes the modern tendency to carry armor over a large area of side, even at the cost of thinning it at the water-line. The twelve British battleships of the third class far exceed in tonnage and sea-keeping qualities the twelve on the French list, and there are many that can be re-armed and brought up to date.

In cruisers Great Britain seems comparatively stronger than in battleships; for she has completed 119, against 32 for France, 13 for Russia, 17 for Italy, and 20 for Germany. Limiting the comparison to first-class cruisers launched since 1886, or now building, Great Britain has 40, aggregating 413,500 tons, against 13 of 109,375 tons for France, and 11 of 96,713 tons for Russia. In the British list are eight of the Terrible class, 14,000 tons and 21 knots; eight of the Cressy, 12,000 tons and 21 knots, and eight of the Diadem and Spartiate classes, 11,000 tons and 20 knots. England's really imposing list, however, is that of her latest line-of-battle ships, which include eight of the Royal Sovereign type, 14,150 tons; nine of the Magnificent, 14,900; six of the Formidable, 15,000 tons; six of the Duncan, 14,000; the Renown, 12,350, and six improvements on her of the Canopus type, 12,950; six of the Admiral type, 10,300, and five more of a displacement somewhere between the Admirals and the Royal Sovereign.

Lord Brassey does not forget the value of England's enormous mercantile marine as an auxiliary for offense and defense. It includes over 70 per cent. of the world's steamers. In 1898 England built no less than 1,367,000 tons, nearly all steamers, and at a recent date had in hand as much more mercantile shipping, besides the warship construction. Of course, this may in one sense be called a source of weakness as well as of strength, because it requires protection in war, but Lord Brassey is confident that a successful system of convoy can be established for it.

PRESENT EFFECTIVE STRENGTH.

	Britain.	France.	Russia.
Battleships—			
First Class	18	8	4
Second Class	11	9	10
Third Class	12	15	1
Total Battleships	41	32	15
Cruisers—			
First Class	21	3	4
Second Class	57	21	7
Third Class	41	11	2
Total Cruisers	119	35	13
Total Battleships and Cruisers	160	67	28

It will be seen from the table that England has a marked total preponderance over the other two powers. With regard to the future her position is still more satisfactory. He has prepared a table showing the probable strength of completed ships at the end of 1899, which is as follows:

ESTIMATED STRENGTH AT END OF 1899.

	Britain.	France.	Russia.
Battleships—			
First Class	23	9	6
Second Class	11	9	9
Third Class	12	15	3
Total Battleships	46	33	18
Cruisers—			
First Class	25	7	7
Second Class	60	23	7
Third Class	42	12	4
Total Cruisers	127	42	18
Total Battleships and Cruisers	173	75	36

—*New York Sun.*

LIQUID FUEL.

The advantages of liquid fuel are well known, and have been repeatedly stated, the best presentation of the subject being Colonel Soliani's article before the Engineering Congress at Chicago in 1893. From the Italian experiments there described one very important fact is deducible which is worth noting, as it corrects a very common, but mistaken, notion, namely, that the use of steam for atomizing the oil is inadmissible on account of the large amount that would be required. In these experiments it was found repeatedly that the steam used for atomizing was less than 2 per cent. of the amount vaporized.

Inasmuch as the evaporative power of fuel oil is from 1.5 to 1.7 times that of coal, a simple calculation will show that, in one of our first-class torpedo-boats, if enough space be reserved for fresh water to make up for the steam used in atomizing, the amount of fuel oil that can be carried in the present bunker capacity will more than equal the evaporative effect of the total amount of coal now carried. This is important, because the steam atomizers involve very little complication, while the use of compressed air involves a good deal.

Another point in connection with the use of fuel oil which should be carefully noticed is that many people conclude, because fuel oil has a greater calorific value than coal, that a boiler worked with liquid fuel will necessarily have a greater power than one worked with coal. This inference is not only not justifiable, but is probably erroneous. The experiments thus far made with liquid fuel under high forcing have shown a rate of combustion equivalent to only about 55 pounds of coal per square foot of grate, while there are reliable data of coal having been burned at the rate of more than 80 pounds per square foot of grate. There are practical difficulties in the way of providing an adequate supply of air for burning the fuel oil in large quantities under a given boiler that make it seem probable that, where the very highest results must be obtained, coal will be used.

The cost and difficulty of obtaining fuel oil in all parts of the world have thus far prevented its general use, and, as far as can be seen now, seem likely to continue to that effect.

TRIAL TRIPS.

The new first-class cruiser Guichen, one of the two commerce-destroyers so-called, has been continuing her trials at Toulon, but up to the present with unsatisfactory results; she is supposed to have a speed of 24 knots, but it has only been possible as yet to get 21 knots out of her, and that with difficulty; it has now been decided to reduce the diameter of the propellers, increase the revolutions, and also to alter the disposition of the weights on board. The general results of the trials of this ship have been so disappointing that, as far as possible, all the details are being kept dark.

The new torpedo-boat destroyer Durandal has been carrying out her trials at Cherbourg successfully, having maintained a mean speed of 27.4 knots with 301 revolutions, or a knot over the speed required by the contract. The *Yacht* claims for the Durandal class, that, although nominally they have a less speed than the English destroyers, yet that they are stronger built, are better sea-boats, and consequently can maintain a high speed under circumstances when the English destroyers would be unable to do so. This, however, has yet to be proved, as there is no very great difference in the relative dimensions of the French and English vessels. The English 30-knot destroyers vary in length from 210 feet to 227 feet 6 inches, and in beam from 19 feet 6 inches to 22 feet, with displacements varying from 285 to 324 tons. The Durandal is 180 feet 5 inches long, with a beam of 19 feet 5 inches and a displacement of 300 tons, while the four latest destroyers of the Épée type are slightly larger, viz., 185 feet 9 inches long with a beam of 19 feet 6 inches and a displacement of 319 tons.

NEW SHIPS.

The contract for the construction of the first-class armored cruiser Sully, one of the modified Montcalm type, has been signed with the Forges et Chantiers de la Méditerranée at La Seyne near Toulon by the Minister of Marine. Her dimensions are to be as follows: Length, 448 feet 6 inches; beam, 65 feet 6 inches; with a mean draught of 22 feet 9 inches on a displacement of 10,000 tons. The armament will consist of two 19.4-centimeter (7.6-inch) guns in turrets, one forward and one aft; eight 16.4-centimeter (6.3-inch) Q. F. guns, four in small turrets and four in armored casemates; six 10-centimeter (3.9-inch) Q. F. guns on the spar deck, which is two more than in the Montcalm class; there will also be eighteen 3-pounder and six 1-pounder Q. F. guns, with two submerged torpedo-tubes. The Sully will have a 6-inch belt of Harveyized steel, tapering to 3 inches towards the extremities, while the guns will also be protected by 6-inch armor, except the 3.9-inch guns, which will have 2-inch shields. There will be three screws, and under forced draught the speed will be 21 knots, while the mixed coal and petroleum fuel will give her at 10-knot speed a range of action of 10,000 miles.

The oil-fuel trials in the torpedo-boat destroyer Surly have virtually been abandoned, it having now been demonstrated that unless special arrangements are made for consuming the smoke the adoption of oil as a fuel is impracticable. When the experiments commenced, about a year ago, great expectations were formed, as it was believed that the liquid fuel would be cleaner, cheaper, and so far automatic in its feed as to save a considerable amount of labor in the stokehold. Throughout the whole of the trials, however, the Surly only once went to sea, and then it was found that owing to the low evaporative qualities of the oil the speed and power were far inferior to what would have been produced by coal. But it was hoped that by improved appliances to so obviate the escape of heat that this difficulty would be overcome, while the absorbing problem was the question of smoke abatement; and to this no solution has been found. Had the authorities been resolved to create the maximum of smoke with the minimum of steam they could not have succeeded better; but this was the exact opposite of what they were striving for. Nor was this one of those experiments that are foredoomed to failure, because the order was given that every mechanical contrivance was to be exhaustively tested until success was assured; but from first to last there was no diminution in the density, the dirtiness, or the nauseous smell of the smoke. Our contemporary the *Naval and Military Record* finds comfort in the failure of liquid fuel, not merely because the adaptation of existing machinery to the new conditions would be expensive and tedious, but because it would be necessary to maintain reserves of oil at all the coaling stations, thus involving risks that are anything but desirable.—*Engineer.*

The six torpedo-boat destroyers laid down at the end of last year are to be called the Dardo, Strale, Nembo, Turbine, Aquilone and Borea. They will have a displacement of 250 tons and a speed of 30 knots. The new torpedo-boat Condore attained a speed of 19 knots under natural and 21.2 knots under forced draught.—*Royal United Service Institution.*

U. S. TORPEDO-BOAT DESTROYER STRINGHAM.

The U. S. S. Stringham, the first torpedo-boat destroyer completed on the Atlantic coast, was put into the water at Harlan & Hollingsworth's yard, Wilmington, Del., on Saturday, June 10. The launch was particularly successful and though it took place in a drizzling rain the enthusiasm of the hundreds gathered about the ship was not dampened. for the boat took the water to the accompaniment of hearty cheers and well wishes. She was christened with the customary bottle of wine by Miss Edwina Stringham Creighton, of Morristown, N. J., a granddaughter of the late Admiral Silas H. Stringham.

In our issue of February last a description of this vessel was given with drawings of the engines and hull. Her construction was authorized by Congress in the act approved March 3, 1897, and the contract for her construction was signed with the Harlan & Hollingsworth Co., of Wilmington, Del., July 29, 1897. The keel was laid March 21, 1898, and the contract date of completion was set at July 29, 1899. The price for hull and machinery, exclusive of ordnance and outfit, is $236,000. She is 225 feet long, 22 feet extreme breadth, and at 6 feet 6 inches mean draught displaces 340 tons. The design in its general features follows the English type of boat, but it is not a close copy of foreign plans. She has four Thornycroft water-tube boilers, and three stacks, the two middle boilers having a common stack. The engines are twin screw, vertical inverted. triple expansion, designed to indicate 7200 horse-power, which is expected to drive the boat at least at the guaranteed rate of speed of 30 knots. Her allowance of coal at the normal draught of water is 35 tons, and her bunkers will stow 120 tons. She carries an unusually heavy battery for boats of her class, as in addition to two deck discharging tubes for 18-inch Whitehead torpedoes, she mounts seven 6-pounder R. F. guns, one on top of each of the two conning towers, and the other five on the deck between the conning towers. The officers' quarters aft consist of a cabin and state-room for the captain, a state-room each for the executive officer and engineer, and a mess-room, abaft which is a pantry and bath-room. Forward of the captain's quarters is a compartment with four berths for petty officers, and one with six berths for machinists. Forward of these is the firemen's quarters with twelve berths. Forward of the firemen's quarters is the engine room, occupying the full width of the boat for 28 feet, and then come the boiler compartments and coal bunkers, which absorb 73 feet of the length of the boat. Forward of the boilers is the galley and then the crew's quarters, with twenty folding berths, and in the extreme bow the windlass compartment. A turtle-back is built from the forward conning tower to the stern, and the latter has a sharp rake instead of being plumb as usual.

The boat was launched with the machinery in position and will soon be sent on her preliminary trial. She is one of the three destroyers contracted for in July, 1897. The other boats of this trio are the Bailey, under construction at Morris Heights, N. Y., and the Goldsborough, building at Portland, Ore. They are of smaller dimensions.—*Marine Engineering.*

TORPEDO-BOAT DESTROYER FARRAGUT—FASTEST VESSEL IN THE NAVY.

U. S. S. Farragut, the first American torpedo-boat destroyer, is now complete, equipped and ready for sea. This fine boat, which is the fastest in our navy, was recently tried and accepted by the Government on the Pacific Coast, she having been built by the Union Iron Works. The contract for this boat was signed October 5th, 1896, and the keel of the vessel was laid July 26th, 1897. She was launched July 16th, 1898, and delivered to the Government December 31st last. Her dimensions are: Length, 214 feet over all; beam, 20 feet; draught, 5 feet 7 inches; and trial displacement, 240 tons.

She is fitted with twin-screw engines of the four-cylinder, four-crank, triple-expansion type, with cylinders 20 inches, 29 inches and two 30 inches diameter and 18 inches stroke. The air pumps are driven direct from the crank shafts by an extension at the forward end of each. The engines are of course designed with a view to getting the maximum power on the minimum weight. Hollow forgings are extensively used, including the crank shafts, each of which is in one piece with the eccentrics forged on. Very complete arrangements for oiling are provided, including centrifugal oilers for the crank pins, and large tubes down the sides of the connecting rods. The main condenser has a copper shell and is placed between the engines with scoops at both ends connected with openings in the bottom, through which the circulating water is forced by the motion of the vessel when steaming. A small circulating pump in the form of a two-bladed propeller is placed in the after scoop to start the circulation when the destroyer is starting out or lying at anchor. The boilers are three in number, of the Thornycroft type, each rated at 2000 horse-power with 240 pounds pressure. The Farragut also carries a distilling plant in the engine-room.

The propellers are three-bladed, of solid bronze, and are carried by forged steel struts far below the keel line, the vessel being cut away tremendously aft for this purpose. They are 6 feet 9 inches in diameter and 8 feet 9 inches pitch, and they turn up 420 revolutions when the boat is going full speed.

In the shape of armament she is fitted with three 6-pound rapid-fire guns, two 18-inch torpedo-tubes. There is a small conning tower forward and another aft. Six torpedoes are carried stowed away forward under the turtle-back.

On trial the Farragut showed an average rate of speed of 30.6 knots. The contract price for the hull and machinery was $227,500.—*Marine Engineering.*

Published designs of the new royal yacht Victoria and Albert for Queen Victoria show an antiquated looking vessel, following very closely in general appearance the present side-wheel vessel of the same name. The new vessel was launched at Pembroke Dock Yard, May 9, by the Duchess of York. She was designed by Sir William White, Chief Constructor of the British Navy, with the view of being used exclusively as a yacht; so that the vessel will not be a combination of warship and pleasure craft, as is the case with yachts of other monarchs. Considered therefore as a yacht pure and simple she is the largest vessel of this type afloat. Her dimensions are: Length, 420 feet; between perpendiculars, 380 feet; beam, 50 feet, and displacement 4700 tons on 18 feet draught of water. It was undoubtedly the wish of her royal owner that the new vessel should be designed so as to closely resemble the present Victoria and Albert, for in other respects the new vessel is strictly up-to-date. She will be fitted with Belleville water-tube boilers, and two sets of four-cylinder, triple-expansion engines of 11,000 collective horse-power, driving twin screws. Her sea speed will be about 17 knots, but she will be capable of spurts of 20 knots. She will be sheathed and coppered, but will carry neither armor nor armament, except possibly a couple of small guns for saluting purposes. She will have high sides with large square ports running her entire length fore and aft; a clipper bow, and overhung stern and two smoke pipes with bellmouth tops.—*Marine Engineering.*

The Seagull, torpedo-gunboat, the only vessel in the navy provided with the Niclausse type of water-tube boiler, carried out a satisfactory eight-hours steam trial at Portsmouth on Tuesday, the 6th inst. The trial of the boiler was begun some months ago, but was abandoned in consequence of the excessive vibration, a defect which has since been remedied by balance weights. The engines were required to develop 2500 indicated horse-power, and the mean of eight hours was 2664 indicated horse-power. The steam in boilers has 150 pounds to the square inch, which was found to be in excess of the amount required to produce 240 revolutions a minute, as stipulated, and which gave the ship the speed of 17½ knots, with a coal consumption of 1.76 pounds per unit of power per hour.—*Engineering.*

The fleet of the German Navy consists of 11 battleships, eight coast ironclads, 13 ironclad gunboats, 10 large and 23 small cruisers, three gunboats, about 100 torpedo-boats, 16 training ships, and 13 ships for special purposes, with a total displacement of 326,701 tons and 399,030 horse-power. There are 16 admirals, 811 naval officers, 40 officers of marines, 128 engineer officers, 142 surgeons, 57 ordnance and artillery officers, 41 torpedo officers and engineers, 104 paymasters, 26 retired officers, 207 midshipmen, 120 cadets, 1058 deck officers, 4740 non-commissioned officers, and 17,597 men.—*Engineering.*

The German shipbuilding industry is making strides corresponding with the general commercial progress of the Empire. In 1898 there were in course of construction for foreign navies 22 battleships, viz., one armored cruiser, three big protected cruisers, 10 torpedo-boat destroyers, and eight torpedo-boats. Of these one torpedo-boat destroyer falls to Brazil, one to Japan, together with eight torpedo-boats and one armored cruiser; the latter at the price of 13,000,000 marks. Italy takes four torpedo-boat destroyers, and Russia four torpedo-boat destroyers and three big cruisers, the latter at a value of 24,000,000 marks.—*Engineering.*

A few days ago the final trials of the Holland submarine boat were held over the course in Peconic Bay. The trials were for the purpose of ascertaining the effect of wave motion upon the vessel while going at a high rate of speed while on the surface, and to see if a high speed could be obtained at any increased power. The vessel showed remarkable ability in making rapid headway in moving backward when the power was increased. The trial was made over a thousand-foot course, and the time was 1:23; a trifle more than 112 horse-power was used. This gave the boat a speed of about ten knots an hour. The new set of dynamos, to be operated by oil, will be installed in the boat to take the place of those now operated by air.—*Scientific American.*

The Holland submarine torpedo-boat has been again tested in Little Peconic Bay. Torpedo trials were made as well as a test for speed and submergence. The torpedo was a dummy of the small Whitehead type and was blown from the tube by air pressure and was taken in a straight line for about 75 feet. There was hardly any disturbance in the water from the discharge of the torpedo, only a few air bubbles showing on the surface near the bow of the boat.—*Scientific American.*

Le Yacht states that four submarine boats of the Narval type are to be built this year at Rochefort, in addition to those building at Havre and Cherbourg. The same paper states that orders have been received at Rochefort to put in hand four torpedo-boat destroyers of the type of the Fauconneau, of which the plans are due to M. Normand. They are to bear the names of Pertuisane, Escopette, Flamberge, and Rapière. Their length will be 56 meters, and their displacement 303 tons. They will each carry one 6.5-centimeter quick-firing gun, six 4.7-centimeter quick-firing guns, and two torpedo-tubes. With 38 tons of coal they are expected to run 2300 miles at 10 knots, or 220 miles at their full speed of 26 knots.—*Scientific American.*

The Dahlgren, in her harbor trial on July 22, developed 29¾ knots. The course was the same over which the torpedo-boat Cushing made her trial trip seven years ago. The trial was under forced draught, with four inches air pressure. The engines made 316 revolutions. Her builders, the Bath Iron Works, have no doubt as to the official trials, which take place in the course of a very few weeks. Her boilers easily maintained a steam pressure of 230 pounds.

The hull of the new torpedo-boat destroyer Bailey, which is being built by the Gas Engine and Power Company, at their works at Morris Heights, is rapidly nearing completion, and it is hoped that the new craft will be launched shortly. The machinery and boilers will not be placed in her until she is launched, and it is expected she will be ready for her speed trial in about a month after launching.—*Scientific American.*

NEW U. S. 30-KNOT TORPEDO BOATS DAHLGREN AND T. A. M. CRAVEN.

The construction of the United States torpedo-boats Nos. 9 and 10, since named Dahlgren and T. A. M. Craven, was authorized by act of Congress passed June 10, 1896, and the contract for these vessels was awarded to the Bath Iron Works, of Bath, Me., on October 6, of the same year. The contract price for the hull and machinery (exclusive of ordnance equipment and outfit) was $194,000 each.

The principal dimensions of these interesting vessels are as follows:

Length over all	151 feet 7 inches.
" on L. W. L.	151 feet 3 inches.
Beam moulded	16 feet 4 inches.
" over guards	16 feet 11 inches.
Depth amidship side	9 feet 4 inches.
" " center	10 feet 0 inches.
Mean draught	4 feet 8 inches.
Draught aft under propellers	8 feet 9 inches.
" " " rudder	6 feet 11 inches.

The Dahlgren and Craven, although designed and built throughout by the Bath Iron Works, are of the Normand type. General T. W. Hyde, the president of the Bath Company, whilst in Europe three years ago, purchased from Mons. A. Normand, of Havre, France, a complete set of plans of the Cyclone, a 145-ton, 29-knot torpedo-boat, then building for the French government, and these plans have guided the Bath yard and have proved of great value in working out problems both in original design and detail work. The guaranteed rate of speed of the Dahlgren and Craven is 30½ knots, this speed to be maintained at sea for one hour. No other shipbuilding firm in the world has as yet guaranteed this enormous speed on such a small displacement as 150 tons, but the builders are confident that these vessels will not only attain the high speed specified in the contract, but will make this speed and carry the required load of 20.29 tons, on a smaller displacement than that specified.

The steel hull of the Dahlgren (now completed) is acknowledged to be the lightest for its size ever constructed, and the machinery is likely to be the lighest per. I. H. P. as yet built in this country. The Dahlgren has a most pronounced hog sheer, with a much higher bow than the Normand boats possess. She has a square forefoot with strong U sections forward. There is a slight drag aft, and the deadwood stops at a point about 15 feet forward of the aft perpendicular, forming the sternpost. Here a large balanced rudder is hung, 6 feet long and about 4 feet 6 inches deep. The midship frames are well rounded; the greatest beam is about 3 feet above the load water-line, and above this point there is a rapid tumble home. The shapes of the midship frames approach very nearly circular sections, thus giving great natural strength, and it is also well to note that the moment of inertia increases as the vessel is heeled; thus giving a higher metacenter when inclined than in the upright position. The water lines aft are very full, and the vessels have the usual Normand knuckle stern which has proved so efficient.

The frames are spaced 20 inches apart, except in the machinery spaces, where they are somewhat closer and located to suit the engines. There are eight watertight bulkheads extending up to the main deck, besides a few non-watertight and the usual wing coal bunker bulkheads. The compartments in the forehold (in the hold forward of the boiler-room bulkhead below the lower deck) are used as chain lockers, and for the stowage of ammunition, torpedo war-heads; water tanks for the reserve feed water and fresh water for domestic purposes are also located here. All the available space in the aft hold is used for the stowage of ammunition. The stern of these vessels is of wrought steel, and the stern-post, rudder frame and shaft brackets, or struts, are of cast steel.

All the steel used in the construction of these vessels is high-grade steel galvanized. The steel before being galvanized had an ultimate tensile strength of 78,000 to 84,000 pounds, with an elongation of 15 to 22 per cent. in 8 inches, and an elastic limit of about 44,000 to 52,000 pounds.

The crew is berthed on the lower deck forward. There are berths for twenty-four men, and the quarters are unusually roomy and comfortable for a racing machine. Just abaft the engine-room bulkheads are two large state-rooms, which together occupy the full width of the ship. The starboard room is for the commanding officer and the port room for the chief engineer. These rooms are complete in all their appointments Just aft of them is the ward room, 7 feet 6 inches by 16 feet. This room contains the usual mess table, lockers, etc., and two sofa berths. Aft of the ward room is the pantry, the officers' w. c. and the companionway which leads into the aft conning tower. Abaft the officers' quarters and separated from them by a steel watertight bulkhead are the machinists' quarters, 16 feet 6 inches long and the full width of the boat. Here four berths and four sofa berths are located, also the usual folding table, lockers, lavatories, etc. The space aft of the machinists' quarters makes a most desirable general store room.

An aluminum alloy is used extensively on these boats. The galley, aft conning tower, cases for spare torpedoes, engine hatch covers, cowls, and all deck opening covers are made of this material, 7-64 inch thick. The main deck is covered with linoleum 5-32 inch thick, but a light wood grating in wood patterns will probably be fitted over the boilers on this deck.

Torpedo-boats of the Dahlgren class have two short, stumpy-looking smoke pipes. They are only 8 feet 6 inches high above the deck—a few inches above the awnings—and are of elliptical section measuring about 4 feet fore and aft and 3 feet athwartships. The galley, made of aluminum, is located between the stacks. It is only 5 feet long and 4 feet wide, but a galley range, coal box, sink and dresser are contained in it. Abreast the galley is a large ventilator cowl about 3 feet diameter, which delivers air to the horizontal ventilating fan used for forced draught, and which is located in the fire room below.

There are two conning towers. The forward one is made of steel, bullet proof. It is of a peculiar shape, for the forward part contains the steering engine and wheel, the helmsman being below the level of the deck so that the lookout can see over his head. The Hyde steam windlass is located just forward of the conning tower. The steering engine is arranged to work the windlass in an ingenious manner. There is no turtle-back fitted on these boats, but a high breakwater runs diagonally aft from the forward side of the conning tower. The aft conning tower, or observation house, is made of aluminum, and, as before stated, forms the companionway to the officers' quarters. The hand steering wheel is placed in this tower.

The boilers in these boats are the largest Normand boilers, and they project through the deck considerably, thus necessitating large boiler casings. The engine casings have also had to be made quite large, as the Normand engine is a short, wide engine, and the top of the cylinders on these boats come just about on a level with the deck.

The Dahlgren and her sister each carry two 14-foot cedar boats and the usual U. S. Navy equipment for this class of vessels. They are fitted with two deck discharging tubes for 18-inch Whitehead automobile torpedoes, both of which are located in the center line of the vessel abaft the engine room casing, one being at the extreme aft end of the deck. They also carry a battery of four 1-pounder rapid-fire guns, two forward and two aft. Coal bunkers are arranged on each side of the boilers, and between the engine and boilers is an athwartship coal bunker. The total bunker capacity is 32 tons, and at full power the consumption will be about 3 tons of coal per hour. About 7 tons of water will be carried in the tanks forward.

There are three large watertight hatches in the main deck with spring covers, which can be opened from either side, communicating with the engine room. Two more lead to the fire room, one leads to the machinists' quarters, one to the general store room aft, one to the crew's quarters, and two smaller hatches give easy access to the back of the boilers. The crew's space is also entered from the forward conning tower. The crew's w. c. is located on the main deck aft. The vessels are rigged with a hinging 30-foot spar alongside the forward conning tower, which will be used for signaling purposes. A wood fender is worked on the sides of these boats for about three-fourths of their length amidships.

As the propellers project beyond the sides of the boats large pipe propeller guards have been fitted aft, the width over these guards being about 15 feet. The Dahlgren's machinery consists of two vertical triple-expansion engines driving twin screws. They have each three cylinders, the diameter being 17¼ inches, 24⅞ inches and 37⅜ inches, with a stroke of 21 inches. The engines are arranged in a common watertight compartment, with the high pressure cylinders forward and the low pressure cylinders aft. The high and intermediate pressure cylinders are fitted with piston valves, and the low pressure cylinders have a slide valve. These valves are operated by the Stephenson link motion. The engines are very compact, the fore and aft dimensions being reduced to a minimum, the valves being all placed on the side. The distance between centers of the high and low pressure cylinders is only 5 feet 8 inches, and the total height of the engine above the center of the shaft is only 8 feet 6 inches. The over-all length of the engine, including thrust bearing, is 11 feet 6 inches, the over-all width being 6 feet. Each engine is designed to indicate 2100 I. H. P. at about 320 revolutions per minute, which is equivalent to a piston speed of 1120 feet per minute. Each engine is fitted with its own independent condenser, made entirely of sheet brass, of the usual torpedo-boat type; but in the vessels of the Dahlgren class great care has been taken with the arrangement of the scoops or inlet and outlet to the condensers. No circulating pump is necessary for ordinary running, as the speed of the boat forces the sea water through the condenser tubes. A small circulating pump is fitted, however, for use in dock trials, etc. The cooling surfaces of each condenser is 1200 square feet, the shell of the condenser being 7 feet long, of curved form, and 3 feet 6 inches diameter. The tubes are of Muntz metal, tinned, 5-8 inch diameter outside, and they are expanded at the ends into bronzed tube sheets 1 inch thick. The tubes are slightly curved to allow for expansion. Each engine has a single acting air pump, 13 1-4 inches diameter cylinder by 4 1-2 inches stroke, driven from the low pressure crosshead. Also two main feed pumps worked from the intermediate pressure crosshead. The shafts, piston rods, connecting rods, valve rods and working parts generally are of forged nickel steel. The high pressure pistons are made of cast iron, the intermediate pistons of cast steel and the low pressure pistons are of forged steel, the pistons being of equal weight. The bed-plates are made of cast steel, and the framing is of Hyde manganese bronze. Each cylinder is steam jacketed. The cylinders are of close-grained cast iron, the barrels being about 3-4 inch thick. The crank, line, thrust and propeller shafts are of forged nickel steel, with a hole drilled axially through them. The crank-shaft for each engine is in one section, 6 7-8 inches outside diameter. The crank pins are 6 3-8 inches in diameter and 11 3-8 inches long. There is a 3 3-8 inch hole bored axially through each crankshaft and a 3-inch hole through each crank pin. The thrust shaft is 6 1-4 inches diameter, forged solid with the crank-shaft; each shaft has eleven thrust collars. The propeller and line shafts are each in one section, 6 7-8 inches diameter with a 4 5-8 inch hole bored through.

The propellers are made of Hyde manganese bronze, the starboard wheel being right and the port wheel being left-handed. They are each 3-bladed, with a diameter of 6 feet 6 inches and a pitch of about 12 feet. The blades have an inclined element of 6 inches.

Each vessel is fitted with two brass feed water heaters 14 inches diameter and 5 feet 3 inches long, the heating surface being about 160 square feet. The air compressor, feed water evaporator, distiller for drinking water, and dynamo are located in the engine room.

The machinery of the Dahlgren class consists of two distinct independent units. Each engine has its own boiler and condenser. There are, therefore, two Normand water tube boilers of the "Express" type. The grate surface of each boiler is 59 square feet, and the heating surface is 2776 square feet. This gives a total grate surface of 118 square feet and a total heating surface of 5552 square feet, the ratio of H. S. to G. S. being, therefore, 46 3-4 to 1. As the designed I. H. P. is 4200, the I. H. P. per square foot of grate surface designed is 35.6, an unusually high figure, and the heating surface in square feet per I. H. P. is 2.32, an equally low figure. There are 1550 tubes in each boiler, and these average about 6 feet long, the outside diameter being 13-16 inch. The working steam pressure is 230 pounds. These boilers have an unusually long grate—9 feet 6 inches. The boilers were made as large as possible—indeed, up to the limit in size—so as to obtain the necessary power with but two units, and thus save space and weight with a corresponding increase in efficiency. A large blower, driven direct by a single cylinder engine, is located in the fire-room. This fan takes air from the large deck cowl overhead and also from the engine-room. Forced draught is fitted in the closed stokehold system, and at full power an air pressure of about 4 inches is expected, the fan making about 750 revolutions per minute. Two auxiliary feed pumps are also located in the fire-room.

The electric plant is very complete for vessels of this type, but no searchlights are fitted. The dynamo is a 1½-kilowatt Riker machine, direct coupled to a Sturtevant engine. The drainage system in these vessels includes seven steam ejectors, with a capacity of 100 tons each per hour, situated in the different compartments amidships, and two ejectors with a capacity of 20 tons each per hour in the two end compartments.

The designed weight of the completed hull of the Dahlgren class was 44.55 tons, and the designed weight of the machinery with water was 78.20 tons. The trial load specified was 20.29 tons, and this weight included 7.06 tons of equipment and 9 tons of coal, the remainder being ordnance weight.

These vessels have been designed to have a radius of action of about 1500 nautical miles at a speed of 14 knots. They have, as before mentioned, a total bunker capacity of 32 tons, and they will probably burn about 630 pounds of coal per hour at this cruising speed. The Dahlgren and the T. A. M. Craven are of about the same size as the U. S. torpedo-boats Foote, Rodgers and Winslow, designed four years ago by the Navy Department. It will be interesting to note, however, that whereas the vessels of the Foote class have machinery of about 2000 I. H. P., the vessels of the Dahlgren class are fitted with machinery capable of indicating at least 4200 I. H. P. on the same displacement—a truly remarkable difference. This great difference in power accounts for the speed raising from 24½ knots in vessels of the Foote class to 30½ knots in vessels of the Dahlgren class, a difference of six knots. As before stated, the Bath Iron Works have guaranteed a speed of 30½ knots on these vessels, this speed being the highest ever guaranteed on any vessel of the size carrying the usual torpedo-boat trial load. It will be interesting to note also that British 30-knot boats have a displacement of 275 to 325 tons, and all the American 30-knot boats, with the exception of the Dahlgren and her sister, have displacements varying from 250 to 450 tons. The Dahlgren and T. A. M. Craven will be given their official speed tests during the fall, and the builders are confident that these vessels will soon be recognized as the fastest vessels of their size and type afloat.—*Marine Engineering.*

THE DUM-DUM BULLET.

The report by medical and military officers on the wounds of the Dum-Dum bullet has been issued. In the *précis* of the reports on the nature of the wounds inflicted by the .303-inch service bullet during the operation of the Chitral relief force the following conclusions are arrived at: 1. The entrance and exit wounds are very similar, the latter being somewhat smaller than the former. 2. The bullet drills through a bone and does not fracture it. 3. At close quarters, although important structures may be injured, the injury is insufficient to immediately cause shock or death. 4. Hæmorrhage is comparatively slow, owing to the smallness of the wound. The medical officers agree that the Dum-Dum bullet is not an explosive projectile, and they quote evidence to that effect. In forwarding the reports received from the medical officers serving with the Chitral relief force in 1895, Major-General Morton, Adjutant-General in India, declares his opinion that the nature of the wounds inflicted by the .303-inch bullet and the absence of shock do not justify the expectation that the present service bullet used with the Lee-Metford rifle would stop a cavalry charge, or a charge of fanatics, such as the British Army is liable to meet on the northwest frontier of India or in the Soudan.—*Engineering.*

THE ENGLISH MARK IV CORDITE AMMUNITION.

The Peace Congress considered the "Dum-Dum" bullet at considerable length, and England strongly opposed any restrictions against its use among savage tribes. There are certain cases, however, where its use really seems to be advisable. When dealing with fanatics like the Soudanese, a war of extermination must be carried on, and the Dum-Dum bullet seems to be the most effective remedy for placing the enemy hors-de-combat, and the bullets are also used in the prison of one of our Western States. Nowadays all the chief powers have small-bore rifles and are liable to become involved in warfare with more or less savage races, as when their colonial possessions are menaced, so that many of them doubtless desire to use the most effective bullet possible. The English "Mark IV" cartridge contains a cordite charge as sent to the Cape. The bullet has a hollow in the head, and the nickel sheath ends on a lip at the entrance. A small disk of nickel is forced down to the bottom of the recess. This bullet when it comes in contact with any moist substance, such as the living body, spreads out into a sort of rounded knob, but the nickel cover prevents any flying or separation of the fragments. If the bullet strikes any hard substance, such as wood, it passes through it, cutting a clean hole. The cordite charge takes the place of the powder in the ordinary cartridge and it is set off by means of a cap and anvil. The Peace Congress prohibited the use of bullets covered with a hard outer case unless the case covers the core entirely and is free from incisions. There has been considerable objection to the Dum-Dum bullet because it is said it does not carry straight. It is likely that it is doomed for modern warfare, but it should not be forgotten, in dealing with savage tribes, they are not particular as to what form of bullet or weapon they use. This ammunition has been tested at Bisley, England. Some of the cartridges caused the bore of the gun to become obstructed and momentarily checked the free expansion of the gas by the stripping on the nickel sheath; this was followed by injury to the guns such as the blowing out of breeches, etc. Cordite is a true explosive, and its use in guns of small caliber requires that the cartridges shall be mechanically perfect to avoid obstructions which tend to cause the barrel to be shattered. The ammunition tests at Bisley showed that economy must not be considered where cordite is used.—*Scientific American.*

TEST OF THE NEW NAVAL 4-INCH GUN.

A new type of 4-inch, 50-caliber gun for the navy has just been tested at the Indian Head Proving Ground, giving excellent results. With a charge of 17 pounds of perforated grain navy smokeless powder, a muzzle velocity of 2991 foot-seconds was obtained, with a muzzle energy of 2049 foot-tons, with a chamber pressure of 16.95 tons per square inch. With a charge of 16¾ pounds a muzzle velocity of 2937 foot-seconds was obtained, with a muzzle energy of 1972 foot-tons.

The gun was designed for 3000 foot-seconds muzzle velocity within the limits of 17 tons pressure per square inch, and there is no doubt but that, with a powder of the proper grain, the requirements will be easily fulfilled. The weight of the new gun is 2.72 tons, while that of the old type 4-inch gun is 1.5 tons. The old type gun, with smokeless powder, has a muzzle velocity of 2200 foot-seconds, and a muzzle energy of 1108 foot-tons. The muzzle energy of the new gun is, therefore, 78 per cent. greater than that of the old.

The old gun has a muzzle energy of 738 foot-tons per ton of gun; the new gun has a muzzle energy of 750 foot-tons per ton of gun. The old gun has 92 foot-tons muzzle energy per inch of shot's circumference, and the new gun has 170 foot-tons muzzle energy per inch of shot's circumference. The old gun has a muzzle energy of 33.5 foot-tons per pound of projectile, and the new gun has a muzzle energy of 62 foot-tons per pound of projectile.

A new type of mount for the heavy 4-inch gun was also tested and worked in a thoroughly satisfactory manner during the firing of the thirty-five rounds to which the gun was subjected.

The new monitors, in addition to their 12-inch turret guns, will each have an auxiliary battery of four of the new 4-inch guns.

The Ordnance Bureau of the navy is much gratified with the performance of the new gun, as the larger calibers of the new high-powered gun now being manufactured for the battleships of the Maine class and the monitors are designed practically on the same lines as the 4-inch gun just tested. The next new gun to be tested will be one of 6-inch caliber, and it will be interesting to note its performance, as a new 6-inch gun manufactured by Vickers, Sons, & Maxim, of England, will soon be fired at Indian Head.—*Scientific American.*

THREE-POUNDER SEMI-AUTOMATIC GUN.

Four semi-automatic guns were secured from the Maxim-Vickers Company during the war. It is a gun which in the rapidity of its fire comes midway between the ordinary rapid-fire type of gun, of which the 6-pounder that did such good work in the late war is the most familiar to the American people, and the fully automatic gun, as represented by the Maxim 1-pounder, one hundred of which have just been finished for our navy at the Washington gun-shops. In the simple rapid-fire gun the three operations of opening the breech, inserting the cartridge and closing the breech are done by hand. In the semi-automatic gun the opening and closing of the breech are done automatically, the only manual operation being the insertion of the cartridge, while in the fully automatic type the opening of the breech, insertion of the cartridge, extraction of the cartridge, and closing of the breech are carried on automatically and continuously by the gun itself as long as there is a feed of cartridges in the belt or hopper.

In the semi-automatic gun the first opening of the breech is done by hand, by pressing down the lever which is attached at the right-hand side of the breech. When the gun is fired a portion of the powder gases enters a small cylinder, and, acting on a piston, serves to throw down the breech-block and eject the empty cartridge case. The act of pushing in a fresh cartridge disengages the breech-block, which is at once closed by a spring. The gain in time occurs through the substitution of automatic for manual closing and opening of the breech. It is not likely that this type of gun will be introduced on our battleships, for it is considered that the increased complication of the breech mechanism and the greater risk of disablement more than offset the greater rapidity of fire. Moreover, the gain in rapidity is not so great as might be supposed, for the speed of fire is determined by the rapidity with which the gun can be sighted, and as the loading in the case of the simple rapid-firer, has to wait on the sighting, it is not clear that any advantage is gained by the semi-automatic principle except in special emergency.

It has been suggested that, in view of the greater carrying power of the 3-pounder, it would be a better weapon to mount in the tops of our warships, and in this connection it is pointed out that very few hits were scored by the 1-pounders in the battle of Santiago. As a matter of fact, however, the 3-pounder, which weighs 1440 pounds complete, and its saddle and stand, is too heavy and too cumbersome a weapon for the tops. It has also been suggested that, on account of its high velocity, rapidity of fire, and carrying power, the 3-pounder should replace the 6-pounders on the superstructure and bridges. This is not desirable, and indeed would be a step backward, for the tendency to-day is to greatly increase the weight of the secondary armament. In the British and Russian Navies the 6-pounder has given place to the 12-pounder 3-inch gun, and it is probable that if a change is made on our ships it will be from 6-pounders to 12-pounders. The 12-pounder is a very formidable weapon at any of the ranges at which a naval fight is likely to take place.—*Scientific American.*

SIR ANDREW NOBLE ON THE RISE AND PROGRESS OF RIFLED NAVAL ARTILLERY.

We only propose here to make a general review of Sir Andrew Noble's paper read before the Naval Architects at Newcastle-on-Tyne, reserving certain features for future notice. It is hardly necessary to observe that the paper is of special importance. Apart from the weight the statements may themselves carry, is to be remembered the fact that Sir Andrew was selected by Lord Armstrong, when the Armstrong gun was first adopted, as the most able professional artillerist that he could meet with, and that from that time Sir Andrew took his place, as we think will be allowed, as the foremost pioneer of artillery in England, Elswick initiating not only almost every advance that was made in artillery in this country, but some of the most important in the artillery world. Of these the one of most practical influence is undoubtedly the introduction of quick-fire ordnance, and so completely was the question grasped, and the lead taken from the beginning, that while the earliest Elswick quick-firing pieces had their sights fixed on the cradles, and were thus unaffected by recoil and available for use during loading, this principle on which the French Chamber some years later insisted as essential to quick laying and firing, was so slowly apprehended that in the Chicago Exhibition in 1893 but few quick-firing pieces had their sights fixed on the non-recoil portion of the mountings. The development of the long "new type" guns in this country, with their slow-burning charges and enormous muzzle velocity and energy, was due mainly to Sir Andrew. The system of mounting the trunnionless guns, and subsequently the small compact carriages with brakes of extraordinary efficacy and power, must be attributed to Rendel and Vavasseur respectively; but all come under the head of Elswick designs, and at Elswick individual assignment is rather discouraged. However, enough has been said to show any readers who may need it the great weight that should be given to the statements in Sir Andrew's paper, and we must proceed to deal with the paper itself.

We may begin with the forward bound that artillery science took in England with the introduction of the Armstrong breech-loading gun, the chief gain being at that time in accuracy, guns not having up to then been made sufficiently strong to bear the strain required to give a long projectile a high velocity, though the short length of piece was responsible for greatly increasing this difficulty. This was the day of wrought iron coil guns, and admirably they answered their purpose until steel was brought to the high standard it subsequently attained. The breech gear caused some trouble in larger calibers in those days, but the 40-pounder was an admirable gun. Iron and steel carriages soon came in, and gradually the investigations made in connection with the Explosives Committee rendered it possible to give higher velocities to elongated shot, and in 1877 the investigations of Noble and Abel enabled 2100 foot-seconds to be reached in 6-inch and 8-inch guns. Besides the gain in energy, which was nearly 75 per cent., the variation in velocity now enabled the laws of perforation to be investigated in a way that had hitherto been impossible. The introduction of quick-firing guns proper had been suggested to Sir Andrew Noble by the success of the machine pieces. The natural complement of these was smokeless powder, and these came in nearly universally together, smoky powder, we may observe, lingering strangely long in the otherwise advanced armaments of the United States, and even exhibiting its power of hindrance in the recent war. Sir Andrew dwells on the sentiment of regret with which he at an early period gave up the black powder, with which he had worked so conspicuously, for smokeless powder, more particularly cordite, which, with absence of smoke, gave 50 per cent. increase of muzzle energy for a given pressure, advantages which it was necessary to secure at the cost of increased erosion and wear of bore produced by smokeless powder, due, in Sir Andrew's opinion, to three causes—heat of combustion, pressure, and motion of products, not to chemical action. This view has been established by many experiments. There is some reason, however, to hope that the temperature of explosion may before long be diminished.

With cordite very high velocities are possible, but for many reasons they do not give energy in the best way. With an aluminium projectile Sir Andrew obtained from a 6-inch gun 100 calibers long a muzzle velocity closely approaching 5000 foot-seconds.

To come to practical results with quick-firing guns. In an early experiment a 5-inch gun got off ten rounds in six minutes sixteen seconds, that is, before the then service gun had fired its second shot.

The improvements in mountings embodied specially the principle of recoil in the line of fire at all angles of elevation. In 1890 the pedestal mounting with cradle was introduced. This is extremely strong, and involving no roller paths, the deck may suffer considerable distortion without interfering with the working of the piece. There is a 3-inch shield balanced and attached by means of flexible straps, so as to save the carriage as far as possible from transmission of shock when the shield is struck. An actual test of the behavior of this mounting for a 4.7-inch gun under the attack of 3 and 6-pounder guns showed its superiority to one with a rigidly-fixed shield, the latter being disabled after one round from each of the above guns, while the former bore four rounds from a 3-pounder, six from a 6-pounder, and two from a 4.7-inch gun before it was disabled; and had the pedestal been made as now, of forged steel, it would not have yielded as it did; even as it was, the damage could have been rectified in a few hours. At Elswick, cast-steel cradles were replaced by those of forged steel in 1894, in consequence of the moulders' strike, and a superior and more trustworthy design has thus come in. The progress in efficiency is seen by a comparison between the 32-pounder of 6.3-inch bore of 1850 and the 6-inch 100-pounder gun of the present day. The former has a muzzle velocity of 1600 foot-seconds, the latter 2570 foot-seconds. The energies are respectively 570 and 4580 foot-tons; but the rapidity of fire and accuracy have been improved in a still more remarkable degree. In the target practice carried on by the navy, each gun's crew has three minutes to do what they can at varying ranges, beginning at 2200 yards, diminishing to 1600, and again increasing to 2200 yards. In H. M. S. Blake the best gun's crew fired eighteen rounds, hitting the target fifteen times, while the total number of rounds fired by her ten guns was 148, the target being hit 110 times. H. M. S. Royal Arthur did nearly as well, the best gun having fired eighteen rounds, and having struck the target fourteen times. After touching on dismounting gear, Sir Andrew's paper then goes on to the arrangements for training and laying guns in swift cruisers, by which one man can train with electric gear through 180 deg. in 30 seconds, and by hand through 60 deg. in 25 seconds. With Mr. Vavasseur, Sir Andrew submitted to the Admiralty a mounting on which a gun could be fired at all elevations up to 35 deg. or 40 deg., which was tested in the Handy with complete success.

A good example of armored gun-house is furnished by that on the Chilian cruiser O'Higgins, which has 8-inch armor in front, and 5-inch on the sides and in rear, the trunk for the supply of ammunition is 5 inches thick. A store of projectiles is carried in the gun-house, and a further supply may be brought up through the trunk which is generally used for the conveyance of cordite charges. In the O'Higgins' gun-house training is effected by electric or hand gear, and in the twin armored gun-houses of several Japanese cruisers the training gear can be worked by hydraulic, electric, or hand power, the projectiles and charges being dealt with as above.

Passing to heavy guns, the 13½-inch 68-ton guns of the Umberto are referred to as an early example of all-round loading, and the provision of a working chamber below the turntable with hoists connecting the position in rear of the gun with the center of the working chamber floor. These features have been brought out in more recent ships.

The original single fixed loading station of the oval barbettes of the Royal Sovereign class were succeeded by a better design, with alternative stations in the Majestic class and the Japanese ships Fuji and Yashima; and had the construction been less far advanced, the last five ships of the Majestic class might have had provision for all-round loading, which first found expression in the English Navy in the Canopus. In future, considerable weight may be saved by increasing the storage of shell below the turntable, and abolishing central shot hoists and shell-rooms at the bottom of the ship. In the Canopus the projectiles are carried to the gun hoists by overhead traveling cranes above the central hoists; in the Albion, by a revolving platform running on rails; and in the Shikishima, by a double overhead rail half moving with the hoist, and half being fixed to the ship; and in the Formidable, by having two shot carriages running on rails carried at the bottom of the trunk of the hoist. A still better provision, devised by Mr. Murray, appears to have solved this problem of supply to the gun in all positions satisfactorily. Sir Andrew, however, expresses a hope that automatic arrangements will not be pushed so far as to degrade the "blue jacket" to a mere machine, and to sacrifice simplicity further than is desirable.

Sir Andrew, in passing to explosives for bursting charges of shells, confines himself to three kinds—gunpowder, gun-cotton and Melinite or Lyddite. Gun-cotton and Lyddite are capable of detonation, and also possess a very much greater potential energy than gunpowder. Distinguishing between the action of shells on unarmored and armored structures, he points out that in the former, that is in the attack of unarmored structures, shells charged with gunpowder do not generally explode until they are some short distance within the side of the vessel, but "with gun-cotton and Lyddite two alternatives have to be considered." "The shell may either be fired with a fuse and detonator, so arranged that the shell will burst immediately on impact, or it may be so arranged as to give rise to a slight delay or hang fire. In the first alternative the shell will burst instantaneously on impact—a result impossible to obtain with gunpowder—and in such cases a hole of very large dimensions, and impossible to plug, will be made in the side of the ship, while innumerable small fragments to which the shell is reduced sweep the deck in the wake of the shell."

"In the second alternative, the shell will probably burst inside, making only a small hole in the side of the vessel, but the full effect of the explosion and the destruction to the crew from the fragments of the shell would undoubtedly be serious, and the case of dispersion of the fragments much larger from the explosion taking place inside the vessel."

"Shell charged with gunpowder against unarmored structures possess, however, one great advantage. The shell will probably burst from 2 feet to 4 feet inside the vessel, and although the dispersion of fragments is not nearly so great as with high explosives, the large fragments into which the shell parts are capable of doing much more serious damage to any portion of the ship's structure with which they may come in contact."

"If fired at armored structures, the results will greatly depend upon the thickness and resistance of the plates, and on the size and energy of the attacking projectile." Generally, it may be stated, that armor is a most effective protection against high explosives, the shell in the large majority of circumstances bursting comparatively harmlessly against the armor. Even if non-fused but with detonators, and possessing "sufficient energy to penetrate the plate, the shell will burst in passing through, but the dispersion of fragments is not very great. If fired without fuse or detonator, wet gun-cotton will not explode, but Melinite or Lyddite probably will, the result to a great extent depending on the thickness of the armor."

Sir Andrew then draws the following conclusions, based on the results of a number of experiments: "(1) To attack unarmored structures, a shell charged with high explosive is a most formidable weapon. The large quantity of explosive that can be carried and the power of immediate detonation permit the vessel to be attacked either by making large holes at or near the water-line, or if the shell should burst on board the effect of the explosion and the destruction to everything in the wake of the shell would be very serious. (2) But with high explosives the shells are reduced to very small fragments, and even very thin steel plates resist penetration. Hence the importance of traverses; and supposing a first-class cruiser to engage two smaller cruisers firing high explosives, one on each broadside, a longitudinal traverse of very moderate thickness would be a protection, the importance of which could hardly be overrated. (3) Having regard to the size of the holes made by high explosives in unarmored structures, I regard it of great importance that, wherever possible, the water-line should be protected from stem to stern with such armor as can be conveniently carried, and that the same protection should be afforded where the guns are carried on the main deck. On the upper deck effective shields, and as thick as can be conveniently carried, should be attached to the mountings. (4) Where an attack is made against thin armor, shell charged with gunpowder are more effective than high explosive shell, as, dependent on circumstances, the former can be got to pass through thin armor and burst inside. I doubt if shell charged with any explosive can be got to pass through thick armor without bursting. (5) There is one serious objection to certain high explosives as bursting charges which is not shared by wet gun-cotton, and that is the liability to detonate if struck by another projectile, or even by a large fragment. Wet gun-cotton is quite safe in this respect, and yet, if fired, for example, by a fulminate, it detonates even more rapidly than in the dry state. This property has led certain governments to adopt it as the high explosives for use on board ship."

In concluding this paper the author defends the Elswick practice, which is "sometimes heard attacked, of mounting as many guns on the broadside as can be conveniently carried. Personally he shared strongly the opinion which a distinguished admiral once made to him, that, supposing a fight between two cruisers equally ably commanded, the victory would remain with the ship that got in first her second broadside, and the victory would be more assured if the broadside were the more powerful. It must also be remembered that with our modern weapons allowance must be made for a gun or two being disabled without altogether crippling the broadside. For these reasons he preferred to carry as many guns as possible, even if the number of rounds carried per gun were reduced."—*The Engineer.*

NICKEL STEEL IN BOILER CONSTRUCTION.

The practical experiments which have been made in the use of nickel steel for boilers have so far given excellent results. Not only is there a lightening of weights due to the superior tensile strength of the alloy, but, what is more important, it has shown both under the test of actual service and in laboratory experiments that it is far more durable than the mild steel ordinarily employed. The saving of weight by the use of the stronger material is not, of course, of so much moment ashore as afloat; but the increased durability which may be given to boilers by using steel for those parts, such as the tubes, which are subject to the most destructive influences, is a question of the very first importance to steam users. Whether the longer life of a boiler built partially or altogether of nickel steel more than offsets its greater first cost may be open to question, but present indications are that it does.

Among the most valuable data on the subject are those afforded by tests which have recently been carried out by Mr. A. F. Yarrow, whose experiments on the question of circulation in water-tube boilers, made a few years ago, attracted much favorable comment and threw upon the subject some greatly needed light. Mr. Yarrow states that the deterioration of boiler tubes is due chiefly to three causes: First, the action of acids in water due to grease; second, the oxidation of the overheated tubes on the outer surface through contact with the hot gases; third, the action of the steam, which if it become superheated decomposes and causes deterioration on the inside of the tubes. Mr. Yarrow made use of lengths of nickel steel and mild steel to ascertain the comparative resisting power of the two materials to the wasting influences above mentioned. This was done in three ways: First, samples were exposed to the action of a dilute solution of hydrochloric acid for certain periods and their weights before and after immersion were compared; then two tubes, one of mild steel and the other of nickel steel, were heated side by side in the same furnace, and the loss due to oxidation through overheating both on the inner and outer surfaces was carefully observed; and lastly, the tubes were heated externally and a jet of highly superheated steam was allowed to act on the inside.

The results in each of the three methods of testing showed the nickel steel to be far superior to the mild steel. In the first test, made on two specimens of the same weight, the loss after 533 hours immersion was in the case of the mild steel 53.19 per cent., while the nickel steel tube had lost only 3.72 per cent.

In the second lot of tests, the amount of oxidation due to the action of fire only was 2.9 times as great in the mild steel as in the nickel steel tubes.

In the third series, with fire outside and superheated steam inside, the nickel steel again demonstrated its wonderful powers of resistance. Each tube weighed originally 612 grammes, and after the test had been running for ten hours, the mild steel tube had burnt entirely through. At this point the nickel steel tube had lost 12.7 grammes as against 85.2 grammes lost by the mild steel. A second mild steel tube was put in, the nickel steel one being retained. After eight hours the second mild steel tube gave out. A third tube was tried and it had been running three hours before the original nickel steel tube gave out, after enduring the test continuously for twenty-one hours. The average life of the first two mild steel tubes was only nine hours. From the last series of tests Mr. Yarrow concludes that deterioration from this cause alone would make it necessary to retube a boiler carrying mild steel tubes 2⅓ times as often as it would one provided with nickel steel tubes.

Another important feature brought out in these investigations related to the permanent increase or decrease in length of boiler plates and tubes due to their heating and cooling. The frequent and sudden variations in temperature due to varying rates of combustion, to opening and closing fire-doors, etc., it is well known, produce permanent changes of length in boiler material. In the present tests exact measurements were taken in order to secure accurate data on a question which so materially affects boiler design. It was found that in a mild steel tube 3½ feet in length, which was heated twenty-one times to a dull red for successive periods of two hours length each, superheated steam at a pressure of 60 pounds being passed through the tube, the permanent reduction of length at the close of the tests was seven-eighths of an inch. Now in the case of a nickel steel tube of similar dimensions exposed to like conditions there was an increase of length of seven thirty-seconds of an inch instead of a contraction. The important bearing of this fact on boiler construction where nickel steel and mild steel are to be placed in juxtaposition is very evident.

Taken altogether, the results of these experiments form a valuable addition to the ascertained data on this subject, and they certainly point to nickel steel as the very material for boiler construction, judged on the score of durability; for Mr. Yarrow estimates that under working conditions boiler tubes containing 20 to 25 per cent. of nickel will withstand corrosion for a far longer period than tubes of mild steel, while their resistance to destruction by the action of heated gases or steam is estimated at about twice as great. Of course it must be borne in mind that the greater cost of the alloy more than offsets its longer life, and for this reason mild steel will probably continue to be used for the ordinary stationary boiler; but for special work, where it is desirable to save weight and avoid frequent repairs, it is certainly the ideal material.—*Scientific American.*

There are few subjects which come before the House of Commons which seem to have a greater attraction for its members than the water-tube boiler, hence when the naval estimates came up for discussion on Friday it was not surprising that the vote of £6,601,000 for shipbuilding, repairs, &c., should form an opportunity on which a number of members could air their knowledge of steam engineering. Mr. W. Allan, who moved the reduction of the vote by £1000, in order to call attention to the failure of the Belleville boilers fitted into some of her Majesty's ships, said the events which had occurred in the fleet during the past twelve months showed that there was something wrong in the mechanical arrangements of our splendid vessels. All the vessels that had recently been fitted with water-tube boilers would unquestionably come home practically as wrecks. He appealed to the First Lord of the Admiralty to appoint an independent committee of experts to investigate the whole question of the condition of our ships. Mr. Goschen, in defending the water-tube type of boiler, said the Powerful had been two years in commission, and they never heard of any defects or difficulties in regard to her boilers, although the runs she had made were superior in speed to anything which had been accomplished by cruisers with cylindrical boilers. In one run she had an average speed of 20 knots an hour for 480 knots. The Admiralty had put the ships with water-tube boilers to much severer trials than any ships had been previously put to. The Terrible had already steamed 20,000 miles, and she performed two sixty-hour trials with perfect success. There had been some leakage not connected with boilers at all, and frequently with cylindrical boilers they had exactly the same experience at the beginning of the ship's commission. But in what had taken place there was nothing to alarm the country. Out of 7600 tubes in the Terrible, only 250 fresh tubes had been required ; and out of 6700 in the Powerful, only the same number of fresh tubes were necessary.—*Engineering.*

BOOK NOTICES.

REMINISCENCES OF THE SANTIAGO CAMPAIGN. By Captain John Bigelow, Jr. Published by Harper Bros.

This book possesses especial interest as having been compiled from a series of letters written home by a regular army officer giving his ideas and impressions from day to day. So many of the accounts of the campaign, having been written from impressions remaining after the completion of the campaign, strive to show reason and give cause for many of the different movements, and make a complete story, that a genuine ignorance of the "why and wherefore" gives a special interest to this personal narrative. His simple and straightforward story of his ignorance of what was coming next, and the suddenness with which he found himself in the fight throw a strong side-light on this interesting campaign.

THE HYGIENE OF THE SOLDIER IN THE TROPICS. By Burat and Legrand. Translated by Capt. G. W. Read, U. S. A. Published by the Hudson-Kimberly Co.

This book gives some interesting comparisons of the losses on the different expeditions sent by European powers to the tropics. It endeavors to point out the causes for these marked variations in the death-rates of different expeditions. It emphasizes the necessity for carefully prepared means of transportation which will allow the soldier to come upon the scene of action in a comparatively vigorous condition. It particularly points out the error in the Madagascar campaign with its prolonged war and immense loss as compared with the Ashantee expedition of the British, finished in two months with practically no loss.

An interesting chapter is devoted to the proper clothing and equipment of a soldier for the tropics as well as the proper food supply. The book will be of particular interest to officers concerned in the fitting out of expeditions to the Philippines as showing present practice abroad from which many useful hints may be obtained.

THE UNITED STATES ARMY AND NAVY, FROM THE REVOLUTION TO THE CLOSE OF THE SPANISH-AMERICAN WAR. Published by The Werner Company.

The narrative which records the annals, together with all the details of administration and the organization, of the army is furnished by Lieut.-Col. A. L. Wagner, while that which recites the history of the navy, and supplies a history of its organization, administration and duties, is written by Commander J. D. J. Kelly, U. S. N. While they cover, in brief, the whole historical ground from the beginning of the Revolution and deal interestingly with the manner in which the Services are commanded and equipped, considerable space is devoted to a graphic account of the operations in the Spanish-American War, the duties of the fleet, and the exploits of the battleships in action.

In the army section of the volume additional chapters explain the meaning of the line and staff, the military departments, and the methods of pay, ration, and subsistence of the rank and file; in like manner other chapters explain the organization of the Navy Department, the navy yards and stations, the education and training of the enlisted men, and the equipment of a ship in commission.

The illustrations are from drawings especially made for the work. They represent the uniforms worn at different periods of the country, several of them showing well-known historical events. This book will certainly prove an education to the many well-wishing but poorly informed friends of both services.

The Naval Pocket Book. 1899. Founded by W. Laird Clowes, edited by L. G. Carr Laughton.

This work has been corrected to February, 1899, and constitutes one of the best books of reference upon the strength of the navies that can be obtained. Ships of approximately equal value can be recognized at once by the lettered classification. Its small size and compact arrangement add much to its handiness for general use.

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THE PROCEEDINGS

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE COAST SIGNAL SYSTEM.

By F. B. ANDERSON, Late Lieut. of U. S. N.

The first official recognition of the possibilities of a coast signal service in connection with the United States Navy was taken when the present Secretary of the Navy issued an order under date of the 18th of October, 1897, appointing a board for the purpose of considering the advisability of coast signal stations as part of the scheme of naval defense.

Commander John Schouler, U. S. N., was named as senior member, the other members being Lieut. C. H. Harlow, U. S. N., then acting as flag lieutenant of the North Atlantic Squadron, and Lieut. J. H. Gibbons, U. S. N., then stationed at the Navy Department and in charge of the Naval Militia Bureau; an invitation was extended to the writer to act as a voluntary member, and accepted.

In accordance with these orders the board assembled at the Navy Department in Washington, D. C., on October 25, 1897, and devoted a great many hours to the consideration of the systems of coast signal stations that had been established in other countries, to the needs of our own coasts, and to the existing means of communication between ships and shore.

The board recognized the important part that properly established signal stations would play in the defense of the country, and made the following report:

NAVY DEPARTMENT,
Washington, D. C., October 27th, 1897.

SIR:—In obedience to an order of the Department, dated October 18, 1897, a copy of which is hereto attached, the board appointed for the purpose of considering the coast signal stations for naval defense, met at 10 A. M. on the 25th instant at the Navy Department.

After consideration of the question the board has the honor to submit the following report:

The board regards the question of communication as divided into two heads—

(*a*) From the sea to the shore.

(*b*) From the shore to the sea; and in its recommendation it has kept in mind such means of communication as are already recognized and established in the naval service within easy reach of the naval militia, and the possibility of enlisting the cooperation of the Treasury Department for using the life-saving stations, particularly such as are or might easily be put in telegraphic communication with headquarters.

(*a*) COMMUNICATION FROM SEA TO SHORE.

Considering the importance of receiving information from a distance beyond the range of visibility, there seems to be but one method which has already had sufficient success to warrant the board recommending it as the best method for communicating from a fleet, scouting vessels, or picket boat at distances ranging from 10 to 50 miles, with a possible extension to 100 miles—the homing pigeon. This, of course, is limited entirely to daylight; but inasmuch as the same difficulties which militate against the successful use of the homing pigeon are present with the fleet or scouting vessels in obtaining information, the board is of the opinion that this service, which already exists in the Navy Department, should be so extended as to cover such points of the coast as are within the control of the Treasury Department or the various State naval militias. At night the use of the search-light for distance of perhaps 10 miles, and the Very's night signals within 15 miles, have been experimented with to such degree of success as to warrant its recommending these two methods for communicating from sea to shore after nightfall.

(*b*) COMMUNICATION FROM SHORE TO SEA.

It is not believed that any system of flags in itself can be relied upon with any certainty, considering the difficulties which a calm, on-shore wind, a hazy atmosphere, and the peculiar character of a shore background present. The board is therefore of the opinion that some system based on the use of shapes or semaphores is the only one which can be relied upon. There already exists in section 1, part 3, of the International

Code of Signals, with which all life-saving stations are either supplied or can easily be supplied, a system of distant signals requiring (1) a ball, pennant and square flag or (2) a 3-armed semaphore. The semaphore, however, should be fitted with four elements instead of three, as it is believed that the holding of the display for any appreciable length of time is of much greater value than the temporary transient display which it is necessary to make with any semaphore having less than the four elements.

It is thought that these 4-armed semaphores can readily be made to conform to existing codes or such codes as could be easily and quickly adapted to meet the peculiar character of the information which they are likely to be called upon to transmit. The board believes that it is necessary for these stations to have men thoroughly conversant with the wig-wag code, and that as far as possible it be required that they must be prepared to receive messages which are sent by this code. It is also believed that the semaphore or shape systems can be readily adopted to meet the demands of the wig-wag code.

It is believed that the means of transmission of intelligence from such stations as may be selected to the main telephone and telegraph wires either already exist or can, with the assistance of the naval militia, quickly be installed and afford a certain method of transmitting intelligence to headquarters.

Having those systems in mind, the board has so subdivided the coast that the important centers, such as naval stations or strategic points, shall be amply protected by the methods proposed; and it has the honor to submit herewith the points at which, in its opinion, homing-pigeon cotes and semaphore apparatus should be installed, and steps be taken to instruct a sufficient number of men at each one of them in the use of these appliances, so that the system may be carried on at least experimentally until more specific arrangements can be made for their care and maintenance. (See Appendix A.)

The board is fully of the opinion that the general supervision of this system of coast signal stations for naval defense should be under the direction of the Navy Department, each State having control of such subsidiary stations as may exist or be established within its limits; that there should be a general supervision exercised by the regular service in such a way that there should be no departure by any one of the districts from the general scheme, which is to be directed by the Navy Department. It believes that a semi-annual inspection by some officers appointed by the Department would be sufficient for this purpose, and that it will devolve upon the naval militia to make also a semi-annual report as to the efficiency of such stations as they may establish in their districts.

It is suggested that the naval militia can very properly take charge of all lines of communication within their districts, establish subsidiary stations in connection with the coast signal stations, keep in touch with the men, and prepare plans for the rapid connection of all stations with the long-distance telephone and telegraph systems of the country. Further, that they make such arrangements with the different telegraph companies as will enable them to keep their information up to date and be able to report all changes to the Navy Department.

Any scheme of this nature will, of course, require the cooperation of the Treasury Department. The naval features of it should be, in the opinion of the board, under the direction of the Bureau of Equipment, and steps should be taken by the Navy Department to secure such cooperation of the Treasury Department as will insure an intelligent assistance in matters of naval defense.

It is believed, as essential to the success of this scheme, that some extra compensation should be awarded to the men that may be called upon to take charge of and manipulate the plant at the various stations.

The board is of the opinion that a compensation at the rate of $5 per month extra for the keeper of each station should be given, and that a certain standard of proficiency in the use of signals be adopted; and, further, that a reward of $10 be held out each six months for all such persons employed at the stations as may be, upon inspection, found to reach the standard.

It is not thought to be within the province of the board to go into details of either pigeon cotes, construction of semaphores, or other methods of signaling. The Bureau of Equipment is already supplied with sufficient information to render the installation of these methods a very simple matter. Their expense, of course, will have to be a subject for special appropriation, but it is not believed that the sum total for all stations will amount to any very considerable sum.

John Schouler,
Commander, U. S. N., Senior Member of Board.

C. H. Harlow,
Lieutenant, U. S. N., Member.

J. G. Gibbons,
Lieutenant, U. S. N., Member.

Frank B. Anderson,
Lieutenant, Signal Officer Naval Militia of New York, Voluntary Member.

Appendix A.

There already exist homing-pigeon cotes at Portsmouth, N. H.; Newport, R. I.; Navy Yard, N. Y.; Norfolk, Va.; Key West, Fla.; Mare Island, Cal.; Assateague Beach, Va., and Cape Hatteras, N. C.

It is proposed to utilize the following life-saving stations:

Machias, Cross Island, Me.

White Head, Me.

The Highland Lights, Cape Cod, Mass.

Chatham, Mass.

Shinnecock, Long Island.

Fire Island, Long Island.

U. S. S. New Hampshire, headquarters First Battalion New York Naval Militia.

Barnegat, N. J.

Atlantic City, N. J.

Wilmington, N. C. (to be governed by its connection with the North Carolina State Militia).

Tybee Island, Ga. (to be governed by its connection with the Georgia State Militia).

St. Augustine, Fla. (to be governed by its connection with the Florida State Militia).

Jupiter Inlet, Fla.

Tampa Bay, Fla.

Pensacola, Fla.

Port Eads, La. (to be governed by its connection with the Louisiana State Militia).

Galveston, Tex.

San Diego, Cal. (to be governed by its connection with the California State Militia).

Port Canby, Cape Disappointment, Wash.

Cape Flattery, Neah Bay, Wash.

The Bureau of Navigation concurred with the board in its recommendations, and the report was forwarded to the Secretary of the Navy, who approved it and returned it to the Bureau of Navigation with orders to take such steps as were necessary for carrying out the recommendations.

The Lighthouse Board and Life-saving Service were consulted, and both heartily entered into the plan, both stating that they would be glad to lend assistance fully and unreservedly.

On February 24, 1898, the acting chief of the Bureau of Navigation stated, in a memorandum to the Bureau of Equipment, that the Bureau believed that the Department was now in possession of sufficient information to warrant the establishment of one or more of the signal stations, and suggested that the first station be established at the Highland Lights, Highland of Navesink, or at Fire Island.

On looking back it seems a pity that this suggestion was not acted upon, as many problems that had to be experimented with during the emergencies of war would have been confronted and solved.

The Naval Militia entered enthusiastically into their share of the work, and spent time and money familiarizing themselves with the telegraph and telephone facilities of their localities; enlisted some of the most expert telegraphers from the ranks of the Associated Press dispatchers, charted the routes of all the trunk lines and sent reconnoitering parties down the beaches to observe the routes of the life-saving telephone lines and actual situation and surroundings of the lighthouses and life-saving stations. Sites for signal stations were selected and every possible preparation made to carry out the ideas of the Navy Department.

On March 15, 1898, Captain C. F. Goodrich, U. S. N., was ordered, in addition to his other duties, to make and report with all practicable dispatch, a preliminary plan of arrangements for establishing a coast signal service on the Atlantic and Gulf seaboards. Captain Goodrich visited all of the principal cities on the Atlantic and Gulf coasts, conferring with the commanding officers of the Naval Militia in each State; he designated the points at which stations were to be located, what gear was to be used, etc., and requested the Naval Militia officers to ascertain the cost of erecting the houses for the shelter of the crews, the cost of the signal masts, flags and other gear, and to obtain bids from responsible persons, agreeing to do the work within a specified time; impressing on all, that the stations must all be established, manned and in full working order in ten days from the time the order was given to commence work; also, to arrange with private owners of land for the occupation of the land during the continuance of the war.

On this trip Captain Goodrich came in personal contact with the officers of the Naval Militia, and the impressions formed no doubt influenced him greatly in picking out the men whose names he sent into the Navy Department for assignment to command of the several districts.

On April 9, Captain Goodrich having reported, the Secretary of the Navy issued the following order:

April 9, 1898.

Sir:—You will at once establish the coast-line system of signal stations for national defense, according to the plans indicated in your reports to the Department. You are put in entire charge of this work, and are responsible for its details, but you will consult from time to time with the board now considering the policy of the Department in matters of offense and defense, and with them will determine just which stations should be established.

Upon your request the bureaus and offices of the Department will give you such assistance as may be necessary to carry the plans into effect.

Seventy-five thousand dollars from the appropriation for national defense has been allotted by the President for the purpose of establishing this system of signal stations. Very respectfully,

JOHN D. LONG,
Secretary.

Capt. CASPAR F. GOODRICH, U. S. N.,
Washington, D. C.

On April 12, Captain Goodrich wrote to the commanding officers of the Naval Militia organizations giving the full list of stations to be established, dividing the two coasts into districts and giving a detailed statement of the number of men allowed at each station, their ratings and also a list of the signal and mess gear that the Department would allow.

On April 12, Captain Goodrich also wrote to the President of the Board on the Plan of Campaign, giving in detail the districts into which he had divided the coasts, the stations in each district, and wrote as follows: "My plans are in such a state of forwardness that practically any one of these stations can be occupied within twenty-four hours and an improvised means of receiving and transmitting signals immediately organized. To permanently equip these stations will take from ten days to perhaps three weeks, depending upon accessibility of the station and its proximity to a great commercial center, whence men and materials can be quickly drawn. In view of extemporizing a service on demand, and of the short time required to place a complete scheme in operation, the board yesterday, as I understand, agreed that, under the circumstances, it was advisable to delay expending the money allotted for the erection of masts and buildings until the necessity should absolutely arise; upon this understanding I am acting."

On the same day Captain Goodrich acknowledged the receipt of the Department's orders to establish the coast signal stations, and advised the Department of the decision of the Board on the Plan of Campaign.

On April 22, he received orders to telegraph the different Naval Militia organizations to establish the coast signal stations, and immediately sent the following message to all the States concerned:

"Establish and man coast signal stations already determined by me. Lowest bids; greatest economy; most speed necessary; let crews sign temporary agreement pending receipt of enlistment forms. No heliographs needed. Send future communications, Superintendent, New York."

GOODRICH.

These telegrams were received late in the evening on the 22d of April, and by midday of the 23d, messages began to come in from up and down the coast, stating that improvised signal stations were ready, and in from ten days to two weeks all stations, with the exception of a few on the Florida coast, located at very inaccessible places, had reported as fully equipped.

Prior to the final order to man the stations, and for ten days after that order was issued, the details of the work in the second district came under my personal supervision, and I feel more intimately acquainted with the work done in that district than that done in any other.

Every class of citizen that I was brought in contact with added something to expedite the work, in spite of the fact that it is rather unusual for a contractor to bind himself to do rush work under a penalty on an uncertainty. Our instructions were not to spend a cent, or to in any way commit the Government until we received our final orders; even when these orders came we were not accredited representatives of the Government, as we did not pass our examinations and receive our commissions until some ten days afterwards. Every department of commercial undertaking was choked with orders for war material of every character; prices went up with a rush, and it was only by using personal acquaintance and friendship that we were able to hold the prices down to the figures which we had sent in to the Department.

The telegraph and telephone companies rushed the work of constructing loops from their trunk lines to the signal stations and to the U. S. S. New Hampshire, which was moored at the foot of East 28th Street, New York City, and was used as headquarters of the 2d District, and, in fact, as the headquarters of the whole system of stations until the latter headquarters was transferred to Washington.

Assurances had been obtained from the civilian employers of the Naval Militiamen that their positions would be held open for them, and arrangements made with the State Government by which the men were paid and fed until such time as the National Government could muster them into the service.

Through the kindness of the Lighthouse and Life-saving Services, the men were sheltered until their shanties could be built, and in such places as it was impossible to use these services, the men lived under canvas.

Building materials, spars, mess gear and signal gear were rushed forward as rapidly as possible; in several instances the freight cars on which the spars and lumber were loaded were hooked on to passenger trains through the courtesy of the railroad officials.

The inhabitants of the towns near coast signal stations for some reason seemed to gather some sense of security on account of having the stations near them, and helped the crews in every conceivable way. One gentleman at Babylon, Long Island, used his fast pleasure steam yacht to carry mail and supplies to Fire Island, and kept this service up during the entire war, making two trips a day and special trips when signaled for.

On April 23, Captain Goodrich was relieved from command of the Coast Signal Service and Captain Theo. F. Kane, U. S. N. (retired) was appointed to succeed him, and on May 9, Captain Kane was relieved and was succeeded by Captain John R. Bartlett, U. S. N. (retired), then in charge of the office of Naval Intelligence. Captain Bartlett came on to New York, assumed command and moved the general headquarters to Washington, where it remained during the war.

Owing to the fact that the men had been sent to the stations without physical examination and without being mustered into the Navy, two surgeons and two line officers were immediately sent out to examine them and muster them in.

Regulations for the government of the service were prepared, printed, and issued, and provision was made for the care of the sick or injured, the Surgeon-General of the Marine Hospital Service cooperating at once on application. Medicine chests, containing simple remedies and directions for the treatment of simple ailments, were at once issued. Log books and inspection blanks, and forms for the return of property, were printed and distributed; routines of watches and drills established; a list of all the stations was printed and issued to all steamship companies; a "Notice to Mariners" was given to the Associated Press, calling attention to the location of the stations, and asking all ship captains to report anything of interest, and advising them that the stations would notify them of any news affecting their safety.

The cooperation of the Lighthouse Establishment, Life-saving Service and Weather Bureau, was sought and granted at once. The Lighthouse authorities pushed the work of connecting all of their most important Light Stations with the telephone systems of the country. The Life-saving Service had the majority of its stations connected by telephone with each other, with outlets at a number of points to the commercial lines, and the Weather Bureau had telegraph communication with all of its stations. By connecting the Coast Signal Stations with the Weather Bureau and Life-saving lines, the Navy Department had complete control of the beaches, and the coast signal stations had communication up and down the beaches as well as inland. Added to this, the life-saving system of patrolling the beaches each night placed every foot of the seacoast as far south as Ocracoke Inlet under the watchful eyes of men who had been trained for years to observe everything that floated and to endure every hardship.

The location of every army headquarters on the seaboard and of every fort or battery was charted, and information was sent out to each district telling how they could be communicated with in case of necessity. This information was also sent to the stations by the district officers.

Owing to the fact that the life-saving crews are laid off during the months of June and July, and that the coast signal service would lose a very valuable, if not its most valuable, ally, it became necessary to bring about legislation that would allow the retention of the majority of these stations in commission, and that would furnish the money necessary to pay the crews. This was accomplished, and the bill appropriating seventy-five thousand dollars became a law on June 7, 1898. It might be interesting to note that the fact of the life-saving stations being in commission during the usual off months, resulted not only in perfecting the system of signal stations, but in rendering valuable aid to the San Francisco when she went ashore, and in the saving of lives and property from several wrecks that occurred during the summer.

Experience taught the necessity of changing the location of some of the stations and the final distribution was as follows:

Appendix I.

List of Stations of the Coast Signal Service on the Atlantic and Gulf Coasts of the United States.

[Navy Department, Washington, D. C., United States Coast Signal Service. John R. Bartlett, Captain, U. S. N., Superintendent.]

[Light-houses, life-saving stations, and Weather Bureau stations are co-operating with the United States Coast Signal Service. Messages will be sent direct to headquarters at Washington from all these stations.]

LIST OF DISTRICTS.

First district, United States Coast Signal Service, West Quoddy Head, Maine, to Gay Head, Marthas Vineyard, inclusive; headquarters, U. S. S. Minnesota, Boston, Mass.

Second district, Block Island, R. I., to Cape Henlopen, Del., inclusive; headquarters, U. S. S. New Hampshire, New York City, N. Y.

Third district, Cape Henry, Va., to Cape Fear, inclusive, headquarters, Navy Yard, Norfolk, Va.

Fourth district, Georgetown, S. C., to St. Simons Island, Ga., inclusive; headquarters, Light-House Inspector's Office, Charleston, S. C.

Fifth district, mouth St. Johns River, Fla., to Cape Florida, inclusive; headquarters, Jacksonville, Fla.

Sixth district, Key West, Fla., to Egmont Key, Fla., inclusive; headquarters, Port Tampa, Fla.

Sixth-A district, Santa Rosa Island, Fla.; headquarters, Navy Yard, Pensacola.

Seventh district, Mobile, Ala., to Galveston, Tex., inclusive; headquarters, Armory Naval Battalion, New Orleans, La.

Station.	Location.	State.
Light-house	West Quoddy Head	Maine.
Life-saving station	Quoddy Head	Do.
Light-house	Moose Peak	Do.
Do	Baker Island	Do.
Coast signal station	do	Do.
Do	Lanes Island, Vinal Haven	Do.
Light-house	Owls Head	Do.
Do	White Head	Do.
Life-saving station	do	Do.
Light-house	Marshall Point	Do.
Life-saving station	Hunniwells Beach	Do.
Light-house	Pond Island	Do.
Do	Cape Elizabeth	Do.
Coast signal station	do	Do.
Light-house	Cape Neddick	Do.
Life-saving station	Jerrys Point	New Hampshire.
Coast signal station	Appledore Island, Isle of Shoals	Do.
Life-saving station	Rye Beach	Do.
Do	Salisbury Beach	Massachusetts.
Light-house	Newburyport	Do.
Life-saving station	Plum Island	Do.
Do	Knobbs Beach	Do.

Station.	Location.	State.
Coast signal station	Cape Ann (Rockport)	Massachusetts.
Light-house	Cape Ann, Thatchers Island	Do.
Do	Eastern Point	Do.
Life-saving station	Point Allerton	Do.
Light-house	Plymouth (Gurnet)	Do.
Do	Race Point, Cape Cod	Do.
Life-saving station	do	Do.
Do	Peaked Hill Bars	Do.
Do	High Head	Do.
Do	Highland	Do.
Coast signal station	Cape Cod Light	Do.
Life-saving station	Pamet River	Do.
Do	Cahoons Hollow	Do.
Light-house	Nauset Beach	Do.
Life-saving station	do	Do.
Do	Orleans	Do.
Do	Old Harbor	Do.
Do	Chatham	Do.
Weather Bureau	do	Do.
Life-saving station	Monomoy	Do.
Light-house	do	Do.
Do	Great Point (Nantucket)	Do.
Life-saving station	Coskata (Nantucket)	Do.
Weather Bureau	Nantucket	Do.
Light-house	Sankaty Head (Nantucket)	Do.
Life-saving station	Surfside (Nantucket)	Do.
Do	Great Neck (Nantucket)	Do.
Light-house	Hyannis	Do.
Weather Bureau	Vineyard Haven, Marthas Vineyard	Do.
Light-house	Gay Head, Marthas Vineyard	Do.
Coast signal station	do	Do.
Light-house	Dumpling Rock, Buzzards Bay	Do.
Do	Point Judith	Rhode Island.
Life-saving station	do	Do.
Do	Watch Hill	Do.
Light-house	Sandy Point (north light), Block Island	Do.
Do	Southeast Light, Block Island	Do.
Coast signal station	Block Island Light, Block Island	Do.
Do	Montauk Point, Long Island	New York.
Light-house	do	Do.
Life-saving station	Ditch Plain, Long Island	Do.
Do	Hither Plain, Long Island	Do.
Do	Napeague Beach, Long Island	Do.
Life-saving station	Amagansett, Long Island	Do.
Do	Georgica, Long Island	Do.
Do	Mecox, Long Island	Do.
Do	Southampton, Long Island	Do.
Do	Shinnecock, Long Island	Do.
Light-house	do	Do.
Life-saving station	Tiana, Long Island	Do.
Do	Quogue, Long Island	Do.
Coast signal station	do	Do.
Life-saving station	Petunk, Long Island	Do.
Do	Moriches, Long Island	Do.
Do	Forge River, Long Island	Do.
Do	Smiths Point, Long Island	Do.
Do	Bellport, Long Island	Do.
Do	Blue Point, Long Island	Do.
Do	Lone Hill, Long Island	Do.
Do	Point of Woods, Long Island	Do.

STATION.	LOCATION.	STATE.
[oa]ST SIGNAL STATION	Fire Island, Long Island	New York.
[Li]ght-house	do	Do.
[Li]fe-saving station	do	Do.
Do	Oak Island, Long Island	Do.
Do	Gilgo, Long Island	Do.
Do	Jones Beach, Long Island	Do.
Do	Zachs Inlet, Long Island	Do.
Do	Short Beach, Long Island	Do.
Do	Point Lookout, Long Island	Do.
Do	Long Beach, Long Island	Do.
Do	Rockaway Point, Long Island	Do.
Do	do	Do.
[M]arine office	Sandy Hook	New Jersey.
[L]ight-house	Navesink	Do.
[L]ife-saving station	Seabright	Do.
Do	Monmouth Beach	Do.
Do	Long Branch	Do.
Do	Deal	Do.
Do	Shark River	Do.
Do	Spring Lake	Do.
Do	Squan Beach	Do.
Do	Bay Head	Do.
Do	Mantoloking	Do.
Do	Chadwick	Do.
Do	Toms River	Do.
Do	Island Beach	Do.
Do	Cedar Creek	Do.
Do	Forked River	Do.
Do	Barnegat	Do.
[C]OAST SIGNAL STATION	do	Do.
[L]ife-saving station	Loveladies Island	Do.
Do	Harveys Cedars	Do.
Do	Ship Bottom	Do.
Do	Long Beach	Do.
Do	Bonds	Do.
[L]ight-house	Tucker Island	Do.
[L]ife-saving station	Little Egg	Do.
Do	Little Beach	Do.
Do	Brigantine	Do.
Do	South Brigantine	Do.
Do	Atlantic City	Do.
Do	Absecon	Do.
Do	Great Egg	Do.
Do	Ocean City	Do.
Do	Pecks Beach	Do.
Do	Corson Inlet	Do.
Do	Sea Isle City	Do.
Do	Townsend Inlet	Do.
Do	Avalon	Do.
Do	Tathams	Do.
Do	Hereford Inlet	Do.
Do	Holly Beach	Do.
Do	Turtle Gut	Do.
Do	Cold Spring	Do.
Do	Cape May	Do.
Light-house	Cape Henlopen	Delaware.
COAST SIGNAL STATION	do	Do.
Life-saving station	do	Do.
Do	Rehoboth Beach	Do.
Do	Indian River Inlet	Do.
Do	Fenwick Island	Do.
Light-house	do	Do.

Station.	Location.	State.
Life-saving station	Isle of Wight	Maryland.
Do	Ocean City	Do.
Do	North Beach	Do.
Do	Green Run Inlet	Do.
Do	Popes Island	Virginia.
Light-house	Assateague	Do.
Life-saving station	do	Do.
Do	Wallops Beach	Do.
Do	Metomkin Inlet	Do.
Do	Wachapreague	Do.
Do	Parramore Beach	Do.
Light-house	Hog Island	Do.
Life-saving station	do	Do.
Do	Cobb Island	Do.
Do	Smith Island	Do.
Do	Cape Henry	Do.
Light-house	do	Do.
Coast signal station	do	Do.
Weather Bureau	do	Do.
Life-saving station	Seatack	Do.
Do	Dam Neck Mills	Do.
Do	Little Island	Do.
Do	False Cape	Do.
Do	Wash Woods	North Carolina.
Do	Currituck Inlet	Do.
Do	Whales Head	Do.
Light-house	Currituck Beach	Do.
Life-saving station	Poyners Hill	Do.
Do	Caffeys Inlet	Do.
Do	Paul Gamiels Hill	Do.
Weather Bureau	Kitty Hawk	Do.
Life-saving station	do	Do.
Do	Kill Devil Hills	Do.
Do	Nags Head	Do.
Do	Bodie Island	Do.
Light-house	do	Do.
Life-saving station	Oregon Inlet	Do.
Do	Pea Island	Do.
Do	New Inlet	Do.
Do	Chicamacomico	Do.
Do	Gull Shoal	Do.
Do	Little Kinnakeet	Do.
Do	Big Kinnakeet	Do.
Light-house	Cape Hatteras	Do.
Life-saving station	do	Do.
Do	Creeds Hill	Do.
Do	Durants	Do.
Weather Bureau	Hatteras Inlet	Do.
Coast signal station	do	Do.
Life-saving station	Ocracoke	Do.
Light-house	Cape Lookout	Do.
Coast signal station	do	Do.
Do	Carolina Beach	Do.
Do	Georgetown Light	South Carolina.
Life-saving station	Sullivans Island	Do.
Coast signal station	Morris Island	Do.
Light-house	Charleston Light	Do.
Do	Hilton Head	Do.
Coast signal station	do	Do.
Do	Tybee Island	Georgia.
Do	St. Simons Island	Do.

Station.	Location.	State.
Light-house	Amelia Island Light	Florida.
Coast signal station	Mount Cornelia (mouth of St. Johns River)	Do.
Light-house	St. Augustine	Do.
Do	Cape Canaveral	Do.
Coast signal station	do	Do.
Light-house	Jupiter	Do.
Weather Bureau	do	Do.
Coast signal station	do	Do.
Do	Cape Florida	Do.
Do	Key West	Do.
Do	Dry Tortugas	Do.
Light-house	Fort Jefferson, Dry Tortugas	Do.
Do	Sanibel Island	Do.
Coast signal station	do	Do.
Light-house	Egmont Key	Do.
Coast signal station	do	Do.
Do	Santa Rosa Island	Do.
Do	U. S. Navy-Yard, Pensacola	Do.
Do	Mobile Point, Fort Morgan	Alabama.
Light-house	Sand Island	Do.
Do	Ship Island Light	Mississippi.
Coast signal station	Port Eads	Louisiana.
Light-house	South Pass Light	Do.
Life-saving station	Sabine Pass	Texas.
Coast signal station	Galveston (south limit of city)	Do.
Life-saving station	Oak Island	North Carolina.
Do	Galveston	Texas.
Coast signal station	Lake Worth Settlement, West Palm Beach	Florida.

139 Life-saving Stations.

50 Lighthouses.

7 Weather Bureau Stations, and the marine office at Sandy Hook, N. Y.

The crews at the coast signal stations consisted of one chief quartermaster, three quartermasters of the second class, and one landsman. At several of the more important stations, an extra telegraph operator, rated as quartermaster of the second class, was allowed. The men were armed with rifles, and were at all times under regular Navy discipline as to watches and drills and as to all matters affecting the efficiency and health of the men.

Routine daily reports were made over the wires to district officers, and by them to the general headquarters, and local tests of the wires were made at the beginning of each watch. Inspections were made by district officers at least once each month and reports made to general headquarters.

Arrangements were made with the telegraph companies to clear the wires when warned, so that the Department could have direct communication with any of the stations, and several experiments tried during the summer demonstrated that this was entirely feasible and took but little time; the wires were cleared between Washington and Miami, Florida, in one-half hour and the two coast signal offices put in direct communication; the same time was taken for Jacksonville, Florida. In this connection it is of interest to note that a message was sent from the Department to the Princeton, off Cape Henlopen, using the ordinary business routes, and an answer received, in twenty-two minutes; the message ordered the Princeton to the Washington yard, and the answer gave the time that she would get under way. Five minutes after she passed in the Delaware Capes the Bureau of Navigation was advised of the fact.

The service stood all the tests to which it was put; the non-appearance of an enemy is the only excuse that can be offered for not reporting one during the entire war; but as long as the Northern Patrol Squadron was kept off the coast, the stations kept the Department in touch with the different vessels, and the letters on file in the Department are evidence that the stations proved of value to several of the navy yards, keeping them advised of the movements of the vessels, and enabling the commandants to anticipate work by a number of hours. They also proved of great value to several departments of the Army by keeping them in close touch with the hospital and supply ships and transports, in many instances receiving and sending all the messages from the transports to the different camps and to Washington. This work could have been expedited and made more general if there had been signalmen aboard all the ships under control of the Army.

The means of communication from the stations to any point on beaches or inland were in every way satisfactory, and are capable of being made perfect at a very small cost, but the problem of off-shore communication still requires considerable study; the shapes which were hurriedly designed did not prove satisfactory, except as a designating mark for the stations; they were too heavy for anything but slow, tedious work, and yet were so light in construction that the high winds soon put them out of commission. At distances beyond flag range, the shapes were often apparently distorted (owing, no doubt, to atmospheric peculiarities), and impossible to read.

The Navy signal-book was not issued, and all signals by flag-hoist had to be confined to the International Code, although the men were drilled daily in reading the Navy Code flags, and provision was made for receiving confidential messages in this code, and for forwarding the numbers to Washington by telegraph.

Very pistols and stars were not issued, but the stations were well supplied with rockets, to be used in connection with a code that was gotten up to provide for emergencies; and all hands were well drilled in the use of the Very Code, and could have received and forwarded any message sent in that way.

The question of an improvised Ardois outfit gave considerable trouble, owing to the limited range of visibility of the best oil lanterns that could be bought; but this difficulty was successfully overcome at Fire Island by using acetylene gas in lamps with specially constructed burners; the small hooded pilot flames in these lamps were lit electrically by means of a spark coil, and the supply of acetylene to the three double burners grouped around the pilot flame was controlled by magnets and dry batteries; it was possible to signal more rapidly with this outfit than with those installed on the ships, as there was never any necessity of waiting for the glow of the carbon filaments to die out. Experiments proved that the lamps could be read at a distance of nine miles. Full drawings and specifications have been filed in the office of Naval Intelligence, Washington, D. C.

Carrier-pigeons were not used for the reason that it takes time to train them, and it was not considered advisable to go to the expense of installing cotes. Events moved so swiftly that when we got around to the question of pigeons, Cervera's fleet had been cooped up in the harbor of Santiago. Then came the destruction of this fleet, and the actual necessity of the coast signal service as part of the scheme of national defense against Spain became unnecessary.

Undoubtedly the most valuable lessons derived from the establishment of the service, are not only the determination of the proper localities for the stations, but the intimate knowledge gained in regard to the splendid chain of stations under the superintendent of the Life-saving Service, which puts the entire control of the beaches in the hands of one man in Washington and the knowledge gained in regard to the Weather Bureau and Lighthouse Services and their electrical connections.

This country is now in a position to establish and maintain an excellent coast signal service without the expenditure of much more money than is already provided for by law. In closing, I do not think it amiss to quote the recommendations given in the report of the Superintendent of the Coast Signal Service to the Secretary of the Navy, all of which were carefully discussed and gone over before being embodied in the report. The suggestions are as follows:

(1) That each life-saving station should be made a Coast Signal station, for the reason that they are all connected (or can be readily connected) with each other by telephone (with offsets to the general telephone or telegraph systems of the country at convenient points) and their system of the patrol of the beach places almost the entire coast line under constant observation. Moreover, the men in this service are trained to see everything that floats within the range of vision, are trustworthy and well disciplined, and are already excellent signalmen with the international code. A knowledge of the "wig-wag" code and the navy night signals would perfect them for the purposes intended. A law should be enacted enabling the President to keep this service in commission during June and July, whenever the public interests demand it, and without special legislation.

(2) That each Weather Bureau station should be made a Coast Signal Service station, for the reason that the observers are trained signalmen with the international code, their stations are exceptionally situated for the purposes intended, and are all connected by wire with the general telegraph systems of the country.

(3) That the light-houses so situated as to fill in the gaps between the life-saving stations and the Weather Bureau stations be made Coast Signal Service stations, for the reason that it is possible at moderate expense to provide them with telegraph or telephone connections. Many of these connections have been made.

(4) That permanent Coast Signal Service stations be established at Monhegan Island (when connected with the mainland by cable); Rockport (Cape Ann), Mass.; Highland Lights (Cape Cod), Mass.; Montauk Point, N. Y.; Fire Island, N. Y.; Sandy Hook, N. J.; Barnegat, N. J.; Cape Henlopen, Del.; Cape Henry, Va.; Morris Island, S. C.; Tybee Island, Ga.; Palm Beach, Fla.; Fowey Rock, Fla.; and Sand Island, Fla., for the reason that these points have been found to be important for observation.

(5) That at each of the stations suggested in the four paragraphs above, a four-armed semaphore apparatus and an acetylene gas "Ardois" system be installed, for the reason that these seem to be the best fixed mechanical appliances to meet the requirements of day and night signaling. Also that all stations be provided with "wig-wag" flags, international code signals, and "Very" pistols.

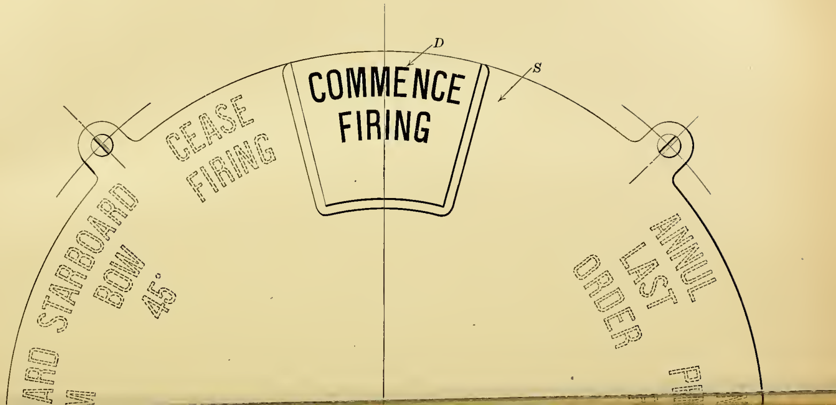
(6) That for use in time of war, a special signal code be prepared and furnished to all the stations of the Coast Signal Service, conforming to the navy code, and using the navy numeral flags and the "Very" pistols, for the reason that, although the international code is ample for communication in time of peace, its universal use makes it of no value when

secrecy is necessary, and a code should be employed in war times which could only be read by those who have been furnished with it.

(7) That experiments be made for the purpose of training homing pigeons in connection with coast signaling, for the reason that they offer a solution of the problem of communication with vessels in the offshore patrol fleet. These vessels would most probably operate in districts having established bases, and at such a distance from the coast and from the inshore patrol that visual signaling would be impossible. A homing-pigeon service cannot be improvised and be of any real value; the birds must be systematically and patiently trained for a year or two, not only to equip the cotes with trained carriers for that locality, but to furnish a stock with sea-bred breeders. Experimental cotes should be located at the bases of Naval Coast Defense districts, a small vessel provided with a carrier-pigeon outfit, and an officer detailed to develop this means of communication and superintend the systematic training of the birds. Unless this is done with intelligence and thoroughness for at least a year it would be useless to rely upon it at all.

Such a system could be very economically inaugurated, and could be maintained at a comparatively slight cost. A simple routine of drills, exercises and reports, based upon our recent experiences, could be readily put into operation, and small rewards or appropriate ratings would stimulate proficiency. In times of peace such a service would be of constant convenience to this Department and to the maritime interests of the country, and the constant practice would prepare the men for the emergencies of war. Attention is called to the fact that every other maritime nation has such a system, generally much more elaborate than the one herein proposed, organized by and operated under its naval or maritime department. I regard it as most essential to the naval and commercial interests of the United States.

The part played by the Naval Militia in this service has met with deservedly high praise, and the men are well adapted to the service. Any scheme for the establishment of a permanent service should take into consideration the possibility of drawing on the service for deep-sea cruising, replacing the crews with Naval Militia.


D
S
COMMENCE FIRING
CEASE FIRING
STARBOARD BOW 45°
ANNUL LAST ORDER

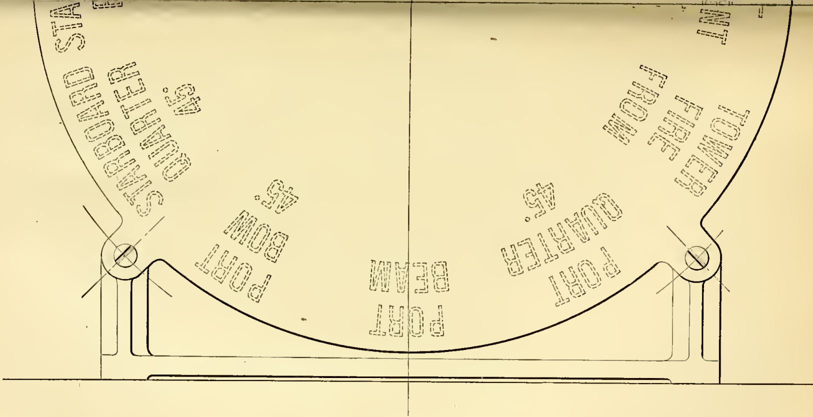


Fig. 1.
DIAL AND SCREEN.
Front View.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ELECTRO-MECHANICAL BATTLE ORDER TELEGRAPH.

Proposed by LIEUT.-COMD'R SEATON SCHROEDER, U. S. N.

DIAL AND SCREEN.

An instrument of the following description is installed at the sending and at each receiving station. They all work in unison, being actuated by the same current; and their functioning is not affected by moderate variations in the strength of the current, the sole office of the current being to excite an electro-magnet at each station.

A dial, *D*, of convenient size, marked in sectors, is made to revolve behind a screen, *S*, of corresponding size, in which a sector is cut away so that only one sector of the dial will be visible at a time. A battle order is marked upon each sector of the dial.

The revolution of the dial is accomplished by means of an electro-magnet, *M*, and a toothed wheel, *W*, rigidly connected with the dial and revolving upon the same shaft. The armature of the magnet is connected by a rod to a radial bar, *B*, which is loose upon the shaft of the toothed wheel but which engages the teeth by a spring pawl.

When the current is admitted to the magnet it causes the radial bar to pull the wheel through a portion of a revolution, enough to bring the next sector of the dial into view. The current being shut off, a spring pulls the armature up and the radial bar back into position ready to pull the wheel through another sector when the current shall be turned on again; so that each display requires one or more positive actions.

A strong spring catch, *C*, engaging the teeth holds the toothed wheel in each position successively to which it is brought, preventing it from turning back; as it presses on the back of the next tooth (which is struck with the same radius), this catch also acts as a friction brake and steadies the wheel and holds it from slipping too far forward. Furthermore, it will push the dial back the short excess of distance that the armature should carry it forward, such excess being required to allow for any dirt or foreign substance which might lodge on the pole or come between it and the armature.

The mechanism is the same for all the dials, both sending and receiving, unless the automatic stop (described later) is attached to the sending.

The number of battle orders can be made as great as desired by increasing the size of the dial; but it is suggested that eleven will be enough, besides one blank sector, all of which could be plainly marked on a disc ten inches in diameter.

Interrupter.

A simple way to interrupt the current is by pulsating with a push-button in the conning-tower, or other sending station. But in the excitement of battle the button might be nervously pushed the required number of times in too rapid succession to excite properly all the magnets, and some might act and others not. To prevent this, a make-and-break wheel or interrupter is introduced in the circuit, which is caused to revolve at a fairly uniform rate of speed by a clockwork on its rear face; this wheel is divided into any convenient even number of sectors, one-third of the surface of each sector being insulated, so that when the button is pushed or a switch turned on, as the wheel revolves the circuit will be closed and broken alternately once for each sector of the dial, thus displaying each in turn. When the desired order is displayed, the button or switch is released by the sender.

The number of sectors of the interrupter should bear such relation to the speed of the clock train as to produce the desired length of contact on each sector. This would best be determined by experiment; if it be one second for each sector, the maximum time that could be required for any order would be 12 seconds. It seems probable that a perfectly certain operation could be effected in half a second for each sector, but this would require inconveniently precise work in releasing the switch.

The *break* surface of each sector is half the size of the *make* surface, as the actual work to be done during the *break* is much

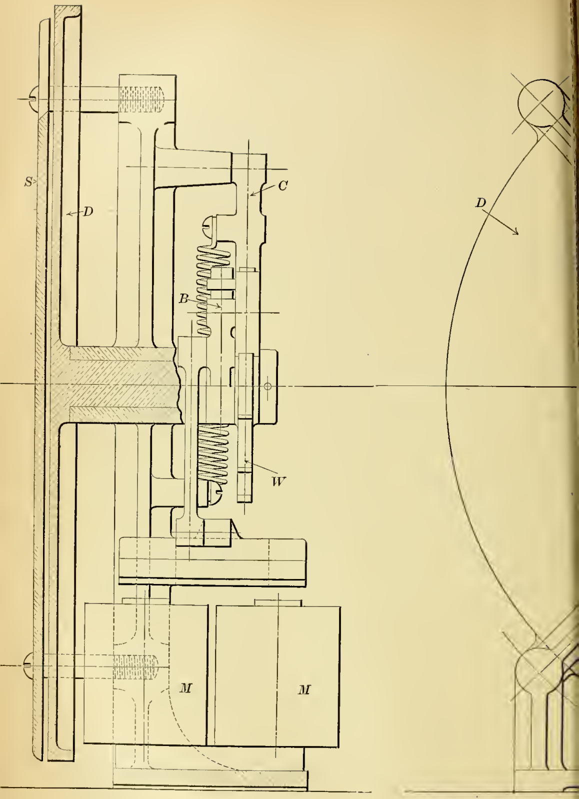


Fig. 2.
DIAL AND SCREEN.
Side View.

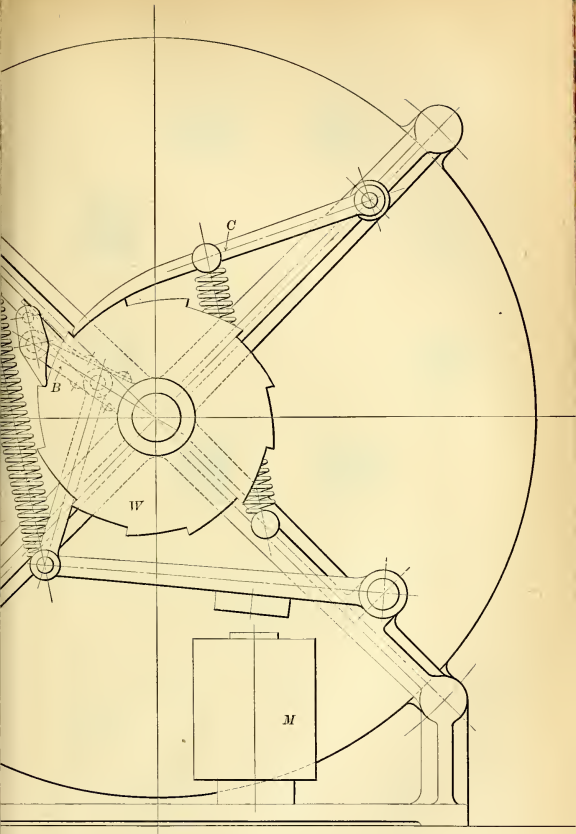


FIG. 3.
DIAL.
Rear View.

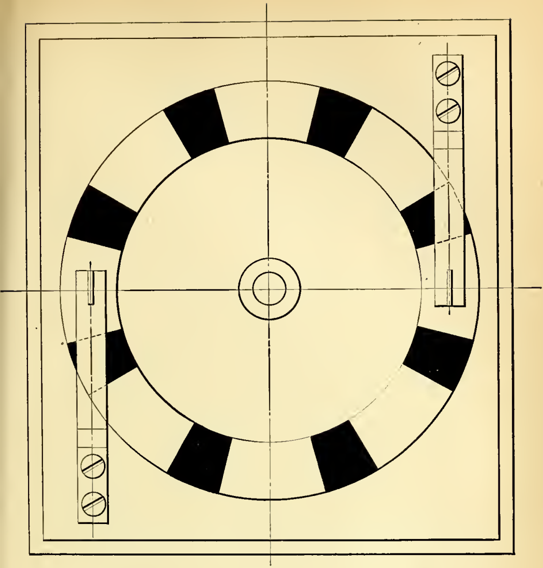


Fig. 4.
INTERRUPTER.
Front View.

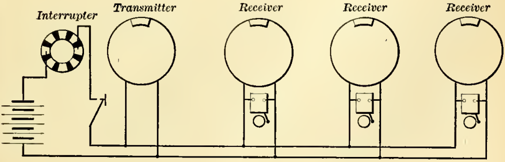


Fig. 5.
DIAGRAM OF CIRCUIT.

less than during the *make.* The current enters by one contact, and, traversing the wheel, leaves by the other.

A switch which will remain turned on until changed is preferable to a push-button, which must be kept pressed all the time, for the reason that in the event of the operator being disabled or diverted while sending an order, the use of the push-button would result in telegraphing some wrong order which happened to be momentarily displayed at the instant of disablement; while with the switch the apparatus would keep on functioning indefinitely and no order would be transmitted, which would be better than sending a wrong one.

All receiving stations and the sending station will be in the one circuit; and at each receiving station there will be a call-bell in the same circuit, which will ring whenever the circuit is closed, calling attention. At the sending station no call-bell is necessary, and there should be none, as the noise would interfere with telephone or other service. At the sending station, also, the dial should differ from the others in having small projections from each sector beyond the screen, upon which should be marked the nature of the corresponding battle orders, so that the sender could note as the desired order was approaching the display aperture and be ready to turn off the switch.

The clock train for the interrupter should be strong, with undetachable key, and designed to run only a few hours, so that at the end of the battle or test or exercise it would finally run down and not be needlessly worked. The fact of its not being wound up on any occasion would be immediately shown by the failure to operate, and the key being always in place it could be promptly wound. All working parts should be heavy and strong, and the magnets should have a vigorous reserve of power.

Circuit.

As the different stations are connected in multiple, an accident to one will not knock out all. It is recognized that when connected in this way there is no indication at the sending station that one of the stations is disabled; but that is not believed to be of equal importance to maintaining all the rest when one is disabled.

If the main should be shot away, the entire system would be paralyzed, as in the case of any mechanism; if the breakage occurred at the instant of sending an order a wrong one might be displayed, but the fact would be known at the sending station, as the same order would remain displayed there. This appears to be the only contingency in which a wrong order could be given, and it is a remote one.

The possibility is contemplated of having one main for the starboard battery and one for the port, with plugs to put in to connect either or both; but it is recognized that any such subdivision detracts just that much from the simplicity aimed at, and may not be of any utility.

The general system is applicable for a range telegraph; it is suggested that the indications commence at 1000 yards and extend in increments of 200 yards to 3000. Within 1000 yards a knowledge of the range is not necessary, and the action would also be too hot to attend to it; beyond 3000 yards the range is not accurately obtainable. As decreasing ranges are apt to vary more rapidly than increasing, the maximum range should be the first in order of arrival at the display aperture, so as to require the minimum interval for telegraphing a decreasing range.

The system may also be applied to a steering telegraph. With several telegraph circuits installed on this system (battle order, range and steering), only one interrupter would be needed; and orders could be sent simultaneously through all the circuits, the only proviso being that the current be strong enough to properly excite the entire number of magnets.

Automatic Stop.

As it may be objected that in time of battle the sender should not be called upon to watch the operation of the instrument, for possibly 12 seconds, in order to shut off when the desired order is displayed, an attachment is suggested for the sending instrument by means of which the sender needs only to put a plug into a socket in the periphery of the dial and then let it operate automatically. This, of course, adds to the amount of mechanism and detracts correspondingly from the simplicity, though not to a prohibitory extent.

Two insulated terminals are secured to the front face of the screen at the sending station. The right-hand one, *R*, constitutes a bracket for a small shaft, the upper end of which terminates in a bell-crank lever, *O*. The left end of the bell-crank presses against a stud or knife switch on the left terminal, *L*,

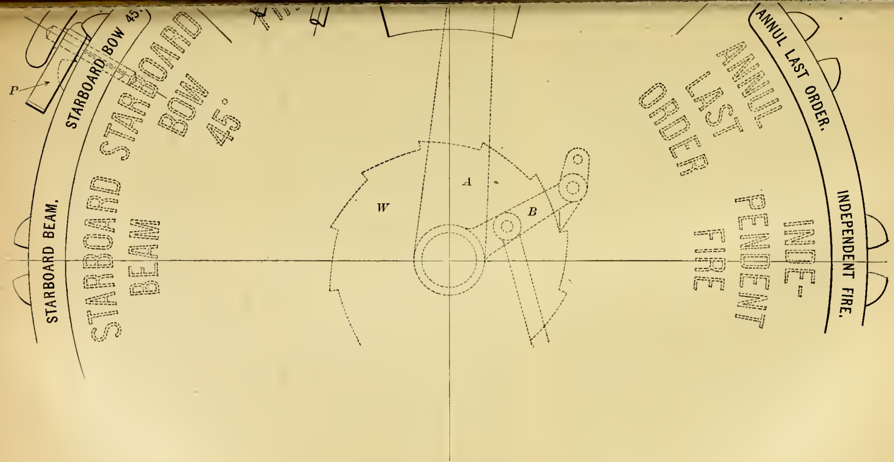
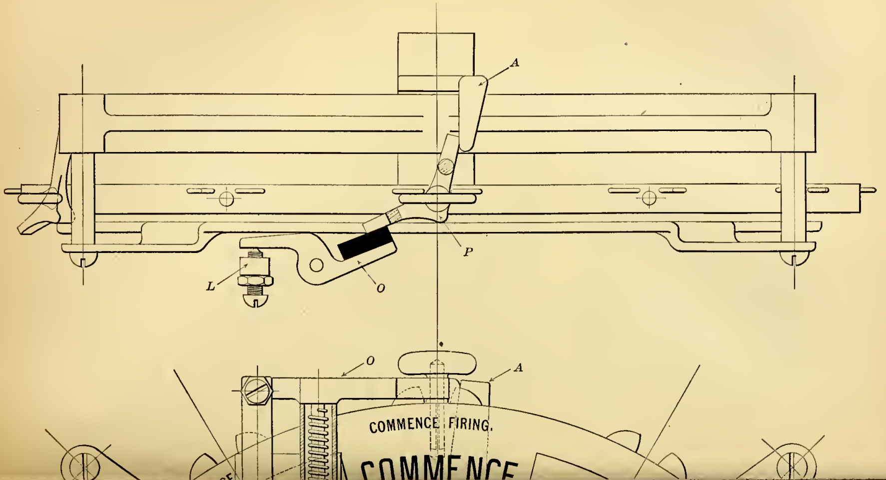


Fig. 6.
FRONT VIEW.

Fig. 7.

PLAN VIEW.



being held in that position by a coiled spring, and completing the circuit. In the periphery of the dial there is a small socket bored in each sector; the shaft of the second bell-crank, *P*, may be plugged into any one of these sockets. An upper arm, *A*, is fashioned on the hub of the radial bar, which, during the reciprocating movements of the bar, moves back and forth through a small arc around the center of the dial.

To stop the dial at any sector, plug the bell-crank, *P*, into the socket of that sector. When that sector reaches the display aperture the bell-cranks will have the relative positions shown in the drawing; the radial bar being released from the magnet and returning to its upper position, its upper arm, *A*, takes on the bell-crank, *P*, breaking the contact of the first bell-crank, *O*, breaking the circuit, and stopping the entire system.

Wishing to send another order; take another bell-crank, *P*, plug it in where desired, and take out the one previously plugged in. The spring around the shaft of the first bell-crank, *O*, turns it back to the original position, closing the circuit again through the left terminal, and starting the system. Guide studs on either side of each socket, together with the peculiar elbow of the bell-crank, compel entering the bell-crank properly; the operation will be facilitated by remembering that the larger, round arm goes to the rear between the studs.

As indicated in the drawing, the arms of the frame and the lugs of the screen for a sending dial with automatic stop are longer than for an ordinary dial, in order to leave room for the bell-crank plug to pass.

The wires indicated at the binding posts are drawn simply to illustrate the circuit. Insulated copper strips on the screen would preferably lead the current to and from the base of the instrument. For the purpose of this attachment, the entire current of the system must pass through the terminals on the screen. As the radial bar has more work to perform, the spring which returns it to the upper position must be strong, and also the magnet; though in all the instruments the reserve power should be more than enough for any such slight increase of weight.

With this attachment in use the speed of revolution of the dial may be much greater; because there is no doubt of the electricity doing its work fast enough, the only limitation being the ability of the sender to seize the right instant to shut off when the automatic stop is not used. This increase of speed would leave it expedient to increase the number of displays if desired.

In manufacture, no doubt a few changes will be found necessary in mechanical details. One instrument was ordered made for experiment at the New York Navy Yard, but it was found that the brass revolving dial plate was too heavy, and the work was stopped. The substitution of a light tin dial would probably remove that difficulty.

It will be observed that with this instrument one signal is eclipsed before another can be made, so that no confusion or uncertainty can arise as to which was the last order.

Desirable orders other than those suggested in the drawing would include " use full charges," " use reduced charges," " use common shell," " use A. P. shell," " use Shrapnel "; while those given, such as " starboard bow," could be given a second meaning, as " watch for torpedo-boat on starboard bow," etc.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE AMERICAN INTEROCEANIC (Ship) CANAL.

A STUDY OF THE COMMERCIAL, NAVAL AND POLITICAL CONDITIONS.

By Captain C. H. Stockton, U. S. N.,
President of the Naval War College.

The completion of a Ship Canal across the Central American isthmus, connecting the Atlantic and Pacific oceans, will undoubtedly mark an epoch in the history of the civilized world. Not only will this be true from the commercial point of view, but the international changes and questions involved are of such a nature, that the words of an English publicist are not too extravagant when he says that it makes "The possibilities of the future so rich and so varied that even the political imagination quails before them."

With the political and commercial results to come from the construction of this new water highway of the world are also naval and military questions of great interest to all maritime countries, but of especial importance to the United States, presenting possibilities that justly claim the attention of officers of the naval service as well as of the statesmen of the country.

To the Navy of the United States the subject of an American interoceanic canal has always been a matter of great interest. Its earliest and most ardent advocates have been members of our profession, and the most indefatigable and persistent explorers and surveyors of the various proposed routes have been officers and men of the Navy.

The effect of the completion and use of the American Canal will differ from that of the Suez Canal, among other things, from the fact that the Suez Canal caused to an extent an alteration, with a consequent shortening and quickening, of trade-routes already in long use, between countries thickly populated, whose staple products were articles of trade and consumption for centuries. The American Canal, on the other hand, connecting the two great oceans of the world, brings direct and central communication by water with the great Pacific, whose existence is a matter of comparatively recent knowledge, and whose countries, to a great extent, of modern discovery and settlement by civilized peoples, are not thickly populated and but partially developed. While the trade of Suez will undoubtedly continue to increase, it will by a steady process; while the trade of the American Canal should increase with great strides, accompanied as it will be with the increased population and development of the west coast of America, with the growth of United Australasia, and with the establishment of stability and trade relations in our new insular possessions in the Pacific and the East, as well as in China and Japan.

With the greatly increased seaborne trade between our Atlantic and Pacific slopes and our insular territory will surely come an increase of shipping under the American flag, mainly of steamers for freight purposes, and the development of the American freight or cargo steamer should follow. With the great increase in number of vessels under our flag, constructed at first for our domestic trade, should we not expect that economy in construction and management will follow to such an extent that we can compete successfully for a large share of the carrying trade of the world?

With regard to the saving in time and distance that will follow by the use of the American Canal, an examination of the map will show this the most effectively. It is perhaps also unnecessary to refer to the avoidance of the long and stormy sea-route by the way of Cape Horn or the Strait of Magellan, or to speak of the natural disadvantages presented in the carrying of freight with economy over the three mountainous ridges between the Atlantic and Pacific coasts. These and troublesome transshipments will be avoided by the Canal, and the world can be circumnavigated by the aid of this Canal and that of Suez north of the equator and in regions of moderate weather and climate.

It is proposed in this article, in view of the partial construction of two interoceanic canals at Nicaragua and Panama, and of the manifest desire on the part of our legislators and people to have an interoceanic canal, to make a study of the conditions that exist and will be affected by the creation of this new great trade route.

The examination will not be confined to the commercial and strategical aspects of this question alone but will include the international relations and policy to be affected thereby so far as these can be surmised at the present day.

The three plans that of late years have been presented for the solution of the question of ship transit to the Pacific from the mid-Atlantic are:

1st. The construction of an interoceanic canal across the isthmus of Panama.

2d. The construction of an interoceanic canal and water-route by the way of Nicaragua; and

3d. The construction of an interoceanic ship railway across the isthmus of Tehuantepec.

The first plan, that of the Panama Canal, upon which work was abandoned in 1889, to be resumed in 1894, is under the control of a French Company, the successor of the one originally formed by De Lesseps.

Ground was broken for this canal in 1882 by the original French Company after the completion of the preliminary work and surveys. From an examination of the various reports and to an extent from a personal examination, it is not unfair to assume that no more than one-third of the work required is completed. The prosecution of the work by the present company is not such as to expect any material change from that proportion of completed work for some time.

Of the Nicaragua Canal and route it may be briefly stated that the route proposed to be followed by this Canal is the final result of many surveys carried on at various times and places in Central America and Mexico by officers of the Navy and under the auspices of the United States Government, and that this route is the one most favored by our people and government. The concession given to a company regularly chartered by the Congress of the United States, by the Government of Nicaragua, resulted in considerable work being done by that company, but less than that done at Panama. The financial suspension of this company in 1893 was, however, followed by a cessation of all work of construction upon the enterprise. Its resumption under the auspices of the United States Government is a subject of investigation and legislation at the present time.

The third and last plan for interoceanic transit was that proposed by the late Captain Eads for a ship railway across the isthmus of Tehuantepec in Mexico. The concession for this railway was granted by the Mexican Government in terms which make it virtually a Mexican affair.

This scheme of transit is so foreign to the ordinary methods of ship navigation that although in a limited or occasional way it may be made an engineering reality and success, it does not seem to be ever likely to become a commercial success or to solve the question of interoceanic transit. In fact, the death of the promoter, upon whose reputation, gained in other undertakings, this scheme seemed to rest, has proven fatal to its progress.

The question of the comparative value of the routes by Panama and Nicaragua from an engineering point of view being a matter of present investigation and report by a commission of competent experts duly appointed in accordance with law by the President of the United States, renders unnecessary any discussion of the matter from this point of view by the writer.

It can be said, however, that both routes have their engineering difficulties. The route by Panama has to deal with such questions as the diversion of the Chagres river and its flood, the water-supply for the locks now proposed, and the permanence of the cut at Culebra; while in turn the Nicaragua route presents such problems as the Ochoa dam, the deep-water harbor at Greytown, and the more frequent earthquakes of this region. Engineering problems seem, however, in these days, to be made only to be solved, and it is doubtful whether any of these mentioned are beyond the skill and capacity of the engineers of the twentieth century.

The distances, however, between Greytown or San Juan del Norte, and Colon in the Caribbean; and Brito and Panama in the Pacific, being comparatively small, the conditions that will apply to one canal and its termini will also apply practically to the other, so that it will not be necessary, so far as this discussion is concerned, to follow but one route or one set of terminal ports. Colon and Panama being at present the converging and diverging points of the trans-isthmian trade already existing will be the ones naturally followed in each ocean.

All of the trade-routes now existing from the east coast of America, from Europe and from the Atlantic generally to the Pacific enter the Caribbean by comparatively narrow channels and passing for a greater or less distance through that sea converge at Colon. These routes are continued, after transshipment by rail from Panama on the Pacific side, by coastwise routes north and south, as at present there are no steamer lines or regular sailing routes that radiate into the broad expanse of the Pacific.

The importance of the waters and approaches of the Gulf of Mexico and the Caribbean Sea in a military sense can be seen at once and will be a subject of detailed examination later.

The present trade-routes by water to the Pacific from the Atlantic are either those by the way of Cape Horn and the Straits of Magellan or those by the way of Colon with a transshipment at the isthmus of Panama. The other routes from ocean to ocean are those by land represented by the transcontinental lines of railway of the United States and Canada, or those partly land railway and partly water, that go by the way of the Gulf and hence overland through Texas or Louisiana, or still others which utilizing the Great Lakes go overland from two or more ports on the western basin of Lake Superior.

The present direct steamer routes from the United States to Colon can be reduced to two: The first from the northern ports of the United States by the way of the Bahamas, the Windward Passage and thence across the Caribbean to Colon. The second route is from the Mississippi and the Gulf ports, across the Gulf of Mexico to and through the Yucatan Channel, and thence along the coast of the western Caribbean to Colon. Besides these routes, a route to Europe and the North Atlantic ports is followed by low-powered steamers and at times by the New York steamers from Colon by the way of theYucatan Channel and the Straits of Florida. In this way the Gulf Stream is utilized and the trade-winds minimized, while Europe-bound steamers of small coal capacity will have our Atlantic coaling ports within easy reach when necessary.

The European routes to the Central American isthmus go across the Atlantic to and through the Virgin group or the

Windward Islands, and then along the length of the Caribbean. The Azores and Madeira afford ports of call *en route*, using either as vessels come from the north or south of Europe.

Sailing vessels from Europe bound for the same destination, as a rule, run into the Trades, crossing the different parallels of latitude at varying points according to the season until 20° N. latitude is reached, when a due-west course is followed to the isthmus of Panama.

The steamer routes from Panama, as already stated, run coastwise north and south, to the northward reaching Central American and Mexican ports and finally San Francisco. At the latter place lines to the north as far as Alaska are to be found and to the westward are the routes to China, Japan, Siberia, our new territory of the Hawaiian Islands, Guam, the Philippines, Tahiti and Australia. The southern route reaches as far as Valparaiso in Chile and there connects with the lines going through the Straits of Magellan, or is continued by that route to Europe and eastern America. The sailing routes to and from the west coast of America, via Cape Horn, are well off-shore, approaching no islands of importance in the Pacific.

The modifications that would come to these various routes after the opening of the interoceanic Canal would be in the matter of a continuity through the canal to the Pacific Coast and the establishment of new and direct routes to Australia, eastern Asia, Hawaii, the mid-Pacific islands and the Philippines from the Atlantic by the way of the Canal.

Europe will reach western America, the mid-Pacific islands and New Zealand by the American Canal, and a rival route to that furnished by Suez will most probably be established via the Central American Canal to western Australia, eastern Asia, and the mid-Pacific islands.

As a summing up of this part of the question, I can do no better than to quote from a recent work of Mr. Archibald Colquhoun, an English authority, upon this subject. He says: " Through the Suez Canal, England has at present the advantage of the United States as regards China, Japan and Australia, by about 2700 miles. The Nicaragua Canal made, the Atlantic cities of the States will be only 1000 miles further from Hong Kong and Central China generally than Britain; 1200 to 1900 miles nearer the northern ports of China, Korea and Japan; 2700 miles nearer the average of the western ports of South America; 1300 miles nearer Melbourne; over 3000 miles nearer New Zealand. The Canal will bring New Orleans 1000 miles and the Gulf ports from 700 to 1000 miles nearer again than New York. The Canal will place the States in touch with 500,000,000 people with whom at present they have comparatively little intercourse, namely the peoples of China, Japan, Korea, Australasia, Malaysia, Ecuador, Bolivia, Peru and Chile."

As to the articles composing the trade now existing to the Pacific from the Atlantic countries, it will be found that the Atlantic coast of North America and Europe furnish almost all of the trade coming from the Atlantic to the Pacific countries. Besides provisions, cotton and petroleum for China, Korea, and Japan are about the only raw or unmanufactured articles coming from the eastward to the Pacific. Europe and our eastern coast send such manufactured articles as wines and spirits, metals and manufactures of iron and steel, cotton, woolen, silk and linen fabrics, and wooden and earthen ware. Corn and its products are not to be found on the Pacific coast, while tobacco comes to our own coast much more from the Atlantic and Caribbean than from the Philippines.

The return trade from the Pacific countries is composed mainly of raw materials, after wines and flour are enumerated; these are such staples as wheat, wool, lumber, gold, silver and other metals, coffee, dried fruits, copra, sugar, nitrates, teas, rice, silks, strawbraids, mattings, hemp, and various other products peculiar to China and Japan.

In making this examination of the subject of trade conditions connected with the Canal, it is found that the trade to and from the West Indies will be comparatively small, there being too much similarity in the tropical and semi-tropical products of both oceans to cause much more interchange of their staple products beyond that which can be taken by vessels *en route* to and from Europe and the east coast of America bound for the Canal.

Fertilizers from the south Pacific, lumber, provisions and canned fruits and salmon from Oregon and California, teas and products from the Orient, will be exchanged in small quantities with tobacco and sugar from these countries of the Caribbean.

A trade also, but not of great moment for the immediate future, will also spring up with the east coast of South America and the Pacific, and also between the east and west coasts of South America.

It is not my purpose to add other estimates to the many that have been formulated of the volume of trade that will go through the interoceanic Canal. No one doubts but that it will be great and rapidly growing, with eventual profit to the Canal builders, but the situation with respect to the Canal from a natural standpoint, always very important, has been so accentuated by the Spanish war and its results, that the question of commercial profit is no longer a vital one in the subject of the construction of the interoceanic Canal. It is no longer a question, either, of the economy of water transportation in comparison with that by land. The economy of each method and the time by land and water routes now come closely together; but with the freedom of a water route will come a freedom from monopoly that will tend more and more to cheaper freights to, and increased commerce between, our Atlantic and Pacific coasts. With the other countries a water route for commerce is alone possible. Besides, the economy attained in rail transportation does not continuously prevail over the entire continent of North America with its three ranges of mountain's grade to be considered and its want in many sections of profitable local trade.

In examining the trade conditions of the canal more in detail, we find, as to the Central American states, that on the west coast English and German steamers already compete with the older Pacific mail lines. These would also be tributary to the Canal. Coffee, so much a staple of Guatemala, Costa Rica, Salvador, and even western Mexico, finds in Germany the great coffee-drinking country of Europe, a large market, which in turn will be reached by the Canal. The Pacific coast line of these countries, rising rapidly to the interior highlands, is not only well suited to the growth of coffee and cocoa but also for the residence of white men. The United States, second only to Germany as a coffee-drinking country, would also afford a market for these products, a market reached principally by the use of the Canal when opened. In return for such products and also for the valuable dye and cabinet woods of the countries, would come the manufactured articles of the Atlantic States and Europe.

Immigration, never properly fostered or perhaps sincerely desired in Central America, would, with the commerce, civilization and stability of government brought by the canal, come from various parts of Europe and the United States to the high, equable regions of interior Central America. The mineral development, now retarded by the poor communications and frequent revolutions of these little countries, would give a development to the mineral wealth of Central America and consequently a quick impetus to this little-known area.

The Pacific coast of Mexico is much greater in its length than that of the Gulf but its development is much retarded by its isolation. Its range of products, like its range of latitude, is greater though its communications are so bad. Coffee, chemicals, salt, dye and cabinet woods are products of this coast with possibilities of coal. The cocoa of the Pacific coast state of Chiapas is unequaled, while the coffee of Colima ranks as high as that of Mocha. Vanilla, upland rice and tobacco are found to the south of Mazatlan, while virgin forests near the coast abound in the valuable wood just referred to. Guano and phosphates, in addition to salt, are found in the Gulf of California, while on the peninsula of Lower California as well as on the opposite main land are mines of gold and silver which have been worked for years.

The United States still leads in the return trade to these countries although many of the resident merchants are English and German. San Francisco and San Diego are the two ports of California for foreign trade. The former city and port is still the great trade center of the Pacific American coast, and the cargo steamer bound for the Asiatic coast will find it not far from the great circle route from the Canal to China and Japan, and hence a convenient and advantageous port of call and coaling. The central position of San Francisco, its mild climate, magnificent harbor, extensive internal waterways and its radiating railway and steamship lines have given it a start and facilities not likely to be overcome by the ambitious cities of the neighboring states of Oregon and Washington. With an unfettered trade to the Atlantic countries will come a greater distributing trade throughout the Pacific. California is pre-eminently a great agricultural, horticultural and mineral State, manufactured articles being still of eastern origin. Coal, which is lacking as a home product, could come here via the Canal from our eastern coasts better than from distant Australia or from the inferior mines of British Columbia and Washington.

The wheat and flour of our Pacific coast would still largely go to Europe by water, and by the Canal; other breadstuffs, canned fish and provisions, leather and tallow, and lumber would follow the same route, while in return general merchandise would come by this new water route.

Alaska, with its mineral wealth, the Aleutian Islands and the ports of Oregon, Puget Sound and British Columbia would have direct trade by, and through the canal, and freight steamer lines to and from western Asia would find profitable stopping places as just mentioned all along the coast-line.

In examining the west coast of South America we find that the western portion of Colombia only awaits the opening of the Canal to furnish its quota of profitable trade with Europe and eastern America. Ecuador already through its principal outlet—the port of Guayaquil—has extensive trade to Europe by means of German, English and other steamers, and the route by way of the Straits of Magellan. Cocoa is the principal staple, but coffee, india-rubber, cinchona and hides are also products of the country, all needed by Atlantic and European markets. Ecuador is a Pacific coast state whose products can go by water alone to a foreign market.

Peru sends its gold and silver ores and its cotton and sugar to Europe, and should share its export of hides, chemicals and wool with the Atlantic coast. A glance at the map will show how much nearer the Canal in every way will bring this part of the Pacific to New York and our east-coast ports. The narrow isthmus makes a very serious break in this trade route, the want of water continuity more than neutralizing this comparatively short distance to the United States.

Chile not only furnishes copper and breadstuffs to Europe, but also of late years sends to both Europe and the United States the nitrates, borax and precious metals from the annexed districts of Tarapaca. All of these countries of the west coast depend upon Europe and America for manufactured articles which will come by way of the Canal.

The islands of the southern Pacific furnish principally copra, sugar, cotton and tropical fruits. Copra will be a product that will pass through the canal, but when in due time the labor question is settled in these islands other products will find their way to the wealthy and thickly populated countries of Europe and America.

New Zealand belongs to the domain of the American Canal both with respect to Europe and the United States. This British colony has much similarity in geographical formation but less in climate to the British isles. With its insular position and good harbors, rich coal deposits and agricultural and pastoral resources, it can in the future become besides a wheat and wool-growing community—a maritime and manufacturing country, and an important factor in the trade of the Canal. Now, its products are mainly wool, frozen meats, gum, flax, tallow and gold, while the imports are cotton, woolen and linen fabrics, hardware and machinery, all from Europe and the United States.

As to the Philippines, now under our own flag, there is sugar, hemp, coffee, tobacco and spices and probably gold and silver ores that are on the surface ready for us when peace and tranquility arrive. What else will be developed under our rule one can only surmise from the reports that reach us. Certainly rice can be made a product not only for export to the coasts near by but to our own coasts. The Dutch East Indies also furnish like products.

The Hawaiian islands will be exploited to the fullest extent now that they are at last American territory. Sugar will not be the only staple, nor its position as a place of call and coaling the only advantage accruing to and from these islands. Coffee is becoming of value as an article of export, its quality being excellent. Sugar, however, is the staple which will make or unmake these islands, and so far the product of the beet-root does not affect their prosperity in the world. The self-supporting capacities can be realized when it is known that after an exhaustive study the late Consul-General Haywood was able to draw up a memorandum showing that the island of Oahu alone could stand a close blockade indefinitely without suffering from want of food.

Although considerable space has been devoted to a discussion of trade-routes and the trade of various countries in connection with the Canal, no attempt will be made to give an estimate of the volume of trade that would be likely to pass through the Canal, nor will any figures be presented to show the future commercial success of this trans-isthmian Canal. They would be at best conjecture. At one time the construction of the Canal hung upon the requirements of commercial interests alone, and the question of the profit arising from the trade passing through the Canal. It is believed that this stage of the history of the proposed Canal has been passed and that the construction of the Canal is required by the interests of the state and as a matter of national policy, and that though the commercial element in the Canal is still a matter of great moment it is not a vital one.

As a consequence, a further study of the future field of the Canal with a view to political and naval needs will be both interesting and important.

Let us commence with the channels by which the most direct routes from the Atlantic and Gulf ports of the United States enter the Caribbean basin, the way to the proposed Canal terminals. These channels are the Windward Passage and the Yucatan Channel, both placed off the eastern and western ends of the great island of Cuba.

In importance of geographical and strategical position with view to the Canal and the routes thereto from the United States, Cuba stands first in order of all the islands and countries of the West Indies. Its commanding position with respect to the Florida Straits and Yucatan Channel on the north and west is augmented by its position towards the Windward Passage and the channel north of Jamaica on the south and east. In addition to this must be borne in mind the position of Cuba towards the Mississippi river and valley, and all that is therein contained. It has been recognized for many years that Cuba stands in the attitude of an outer bar of the Mississippi and that the channels by which the trade of this great river reaches the sea are not those of its delta and passes but those furnished by waters of the Yucatan Channel and Straits of Florida, the outlets of the Gulf of Mexico. Recognizing this as a fact, the importance of the strategical relation borne by Havana to the Florida Straits, Cienfugos to the Yucatan Channel and Santiago and Guantanamo Bay to the Windward Passage becomes evident. These great military ports give Cuba its strategic value to the United States if it remains under the sovereignty of the United States. If it should pass to the control of a sovereignty other than that of our own, it should be one whose policy will be in unison with us.

With Cuba in our possession or sufficiently under our influence, the only other position needed by us in the Caribbean is a sufficiently good military port at or near the eastern terminal of the Canal. This terminal port, whether belonging to the Canal of Panama or that of Nicaragua, is not likely to be more than an artificial harbor or basin for coaling or necessary delay before entering or leaving the Canal. Hence, the purely military port must be looked for elsewhere. To avoid bottling up it should be exterior to the Canal. Fortunately, nearly midway between Colon and Greytown, the terminal points considered, are situated the anchorages and harbors known under the collective name of the Chiriqui lagoon. These waters were discovered by Columbus himself and the northern bay bears the name of the great Almirante. They were surveyed by Captain Barnet of the English navy in 1839, and they have frequently figured in the discussions of trans-isthmian railways and interoceanic canals.

The general rule that the deepest harbors lie alongside the highest mountains has no exception here, and the height of 6000 feet found in the most feasible mountain pass near Chiriqui lagoon banished all ideas of both canal and railway construction. The proximity, however, of the Gulf of Dulce in the Pacific and its fine harbor of Golfito has led to a grouping of these two places together and the acquisition of them both by the United States has been frequently urged. So valuable were these sites that speculators and others acquired a title, more or less valid, to great tracts of land about them. These titles are believed to have become void on account of the non-fulfillment of the conditions required in the original concessions.

Chiriqui lagoon proper is 32 miles long with a width varying from 5 to 12 miles. The entrance is over 3 miles wide with ten fathoms of water, which depth can be carried to all of the anchorages in this lagoon. The channel connecting it with Almirante Bay has a least depth of five and one-half fathoms but is narrow and crooked.

Almirante Bay, to which attention is principally called, is about thirteen miles in extent from east to west, but with its interior so filled with small islands that its shape and width is very irregular, the width varying from 2 to 13 miles. In consequence of its formation this bay has been said to possess harbors within harbors, in which vessels of the largest class may enter without difficulty, and in many places lie alongside the shore in security. This bay has two entrances direct from the sea, known as Boca del Toro and Boca del Drago, both available, especially the latter, for large vessels.

The late Admiral Ammen in a memorandum to the Secretary of the Navy, stated that the Chiriqui lagoon was admirably situated for a coaling station, easily defended against naval attack and was conveniently situated for a naval force intending to control an isthmus canal by the way of Panama or Nicaragua. Captain (afterwards Admiral) Meade reported to the Department that its value to any power desirous of controlling the isthmus would be very great and undoubted. Most of its anchorages, he went on to say, could readily be prepared for defense in the event of war by the ordinary resources of a frigate's crew, and with a few cannon behind redoubts held against a fleet.

I will close this reference to Chiriqui by saying that, as a strategic harbor, in view of future possibilities in connection with the Canal, it has no equal on the coastline of the Caribbean or in the Central American portion of our continent. Of the other islands and ports bearing upon the Canal, it may be worth while to mention the Curaçao which is likely to be a port of coal and watering on the route to the canal and in a limited way the master of the Caribbean. If Germany, as some delight to prophesy, should ever absorb Holland, this island, as the coaling station of a strong military and ambitious naval power would become of greatly increased military importance.

Barbados, placed a little to the eastward of the regular chain of the Windward islands and opposite to a much used passage, would be greatly increased in commercial importance, but its inferior anchorages have caused the neighboring island of St. Lucia to be selected as the English naval coaling station and an establishment there of coaling facilities which will cause it also to be used as a general coaling port for the canal-bound vessels.

Martinique, of the same chain of islands, has been the naval station of the French in the West Indies and it has appliances, especially for docking and repair that excel anything private or governmental that exists in the West Indies, Spanish main or perhaps even our own gulf coast. Its further development by the French may be expected in the case of the opening of the Canal. Fort du France, the naval port of Martinique, was used by the French as an advanced naval base in their operations against Mexico during the time of our civil war.

Jamaica, the largest of the English West Indies, holds a geographical position so important in a strategic sense that it has led to the establishment in Port Royal harbor of the principal English naval station in the West Indies. This station has a most important position with respect to the Windward Passage and to the routes from the northern ports of America to the Canal. It would be the natural base for operations against the Central American coast and was used during the war of 1812 as a base of operations against our Gulf coast and the city of New Orleans.

The island of Hayti, containing the two negro republics of Hayti and Santo Domingo, is interposed between Cuba and Puerto Rico. On account of the frequency of insurrections and the general instability of the government on this island, there is more reason to look for foreign interference than in any other country of the West Indies. In fact, the island with its two semi-civilized states forms the tinder-box, as it were, of the Caribbean. In possession of a foreign power, Samana Bay would leave open Puerto Rico and the Mona Passage and St. Nicholas Mole, and the bays and anchorages in southwestern Hayti could be used as a base of operations against Cuba and the Windward Passage. The Monroe doctrine, as understood at the present day, would not allow the occupation of any part of this island by any European power, except in connection with or anticipation of hostilities with the United States. As to other ports affording secure anchorages and in important geographical positions like St. Thomas and Carthagena, it may be said that so long as they remain under their present control they will have little effect upon the routes to and from the Canal. In the possession of a strong European maritime power, however, situated as they are upon the flank of trade-routes to and from Europe, they would become important factors in the Caribbean situation. It is not likely that our consent to such a transfer could be obtained. Without our consent it is doubtful whether such a transfer would be attempted.

In closing this examination of these waters it is well to emphasize the value of the command of the Caribbean upon the navigation of the Canal in war-time. A blockade upon the east end stops the transit and use of the Canal. One cork is alone necessary for this bottle. With our great interests, our new acquisitions and our close proximity to these waters which would dominate our egress from our own Mississippi and Gulf ports as well as the Canal routes, it is imperative that no matter what demands may be made upon us from other parts of the world, that the naval force on the North Atlantic station should, active and latent, be sufficiently strong to have and retain the command of the sea in the Caribbean. This squadron or rather fleet does the duty that is covered by the English channel and the Mediterranean fleets combined. It should never be neglected, and always contain a sufficient number of the backbone of the fleet; that is, vessels competent to take the line of battle in time of war.

Proceeding to the Pacific Ocean we find that the trans-isthmian trade of the Pacific has for its focus at present the bay and port of Panama. Being one of the existing terminal points of the land-transit route across the isthmus of Panama, it has great value, which value will continue and be increased if the Panama Canal is constructed, but which will be diminished if the Nicaragua Canal is opened to the world. Even Panama would make a base of importance for naval operations to any country having the naval control of the Caribbean waters. From its almost insular conditions and isolation the transit land route would be most likely in the same hands and the necessary communication being maintained by that railway, Panama could be fed and supplied direct from the home country of the power dominating this sea in war-time.

The immediate port and anchorage of Panama is not capable of land defense but the little archipelago known as the Pearl Islands affords many facilities for operations as a base capable of being held by land and fixed defenses.

Along the coast of Central America, to the northward and westward of Panama, are the secure anchorages and natural harbors of Golfito, Port Culebra and Port Elena. They are of a depth sufficient for the largest vessels and with a capacity for defense but without any commercial importance or resources. Their proximity to the Pacific terminus of the Canal alone brings them within the limits of this discussion. In a naval way they would be superior to the little artificial basin proposed to be constructed as the terminal port upon the Pacific of the Nicaragua Canal as well as having a superiority, though in a less degree, to the neighboring and already established ports of Corinto, Amapala and La Union.

Acapulco, the best harbor in Mexico, is conveniently placed upon the west coast as a midway point of call and coaling between the Canal and San Francisco. As a naval factor in the Canal question, Mexico does not exist; it is off the route on the east coast, and but scantily developed upon the west coast. Its development and strength is as a military power, and its navy will be necessarily limited to purely coast-guard purposes. Hence, while Acapulco would figure as a port of much commercial convenience, it is hardly to be considered as having any naval weight in the matters under consideration. Even its limitations as a neutral port in time of war would serve as but a moderate restriction to the passage north and south of belligerent vessels. Magdalena bay, on the outer coast of the peninsula of Lower California, is also in Mexican territory, but is not a port of the convenience or resources of Acapulco. It would not figure in this problem unless an improbable alliance should be entered into by Mexico, or a belligerent, taking advantage of the naval weakness of the Mexicans, should disregard its neutrality and make it a rendezvous and base of operations. Even then it is not beyond the range of possible land operations from Southern California.

The geographical, topographical and climatic characteristics of southern California differ so much from those of northern and central California, from which it is separated by a transverse range of mountains whose lowest passes vary from 4000 to 6000 feet in elevation, that the subject of its naval and military situation should be considered to a great extent apart from that of the remaining portion of the State. The development of California has had several phases, each affecting the question of its resources for offense and defense by land and sea.

It seems hardly credible that shortly after its annexation by the United States announcement was made by one of the highest military authorities to the War Department at Washington that one great difficulty in defending California arose from the fact that breadstuffs would have to be sent from the Atlantic coast for the sustenance of the troops. The mineral, agricultural and horticultural eras of California have succeeded each other in turn and yet this imperial State is but partially developed. It is not too much to expect that a commercial era will come to this coast and that the want of coal will be more than compensated by the improved use of petroleum which is found in such abundance in southern California. San Diego in the south, San Francisco in central California, the Columbia river in the north, and the bays and anchorages in Puget Sound and on the Strait of Fuca give commercial and, to an extent, naval ports whose future will be largely developed by the Canal.

The route approaching the great circle track to China and Japan from the Canal skirts the coast of California as far as San Francisco and the Aleutian Islands. This track may be readily followed by the tramp steamer seeking cargo and important ports of call, while the route via Honolulu with its better climatic conditions will be followed by the through cargo steamers and those carrying passengers for the Orient.

The break in our Pacific coast territory made by Vancouver Islands and British Columbia includes within its limits the naval harbor of Esquimalt with its strong fortifications in the course of erection. Beyond, on the same and adjacent islands, exists also one of the large sources of coal supply for the Northern Pacific. This island, with its naval harbor and dockyard, is now the only territory of a strong European power bordering upon the Pacific coast of America or to be found in the vicinity of our own Pacific coast-line.

The distance and isolation of this coast tends strongly to its naval defense from any power but Great Britain, which has behind its naval station the long line of the Canadian Pacific Railway with its steamer lines running south and west. This isolation from the great naval powers and their home ports will be ended if the Canal is considered in the light of a natural strait free to all navigators or masters.

Of all the countries on the Pacific Ocean, the United States is the only great power whose home territory borders upon this ocean. The development of the Pacific slope during the last half century has been phenomenal, and the naval resources of the coast have of late kept step with the development of the country. The services of the Oregon in the Atlantic campaign during the late Spanish-American war and of the Olympia and Monterey in the Philippines emphasize the fact that the products of the workshops of this coast have become an important element in the naval force of the United States with an effect far beyond the limits of the territory in which they were created. To the possibilities for construction and repair appertaining to the dock-yards at Mare Island and Port Orchard and the Union Iron Works at San Francisco have been added the private shops of Portland, Oregon, and Seattle as builders of torpedo-boats and torpedo-boat destroyers, and yet we are but in the early stages of naval development upon the Pacific coast. The Canal, with the facilities that it will afford for the transport of raw materials to the Pacific coast, will further develop the private and public shipbuilding plants of the coast.

With the great and growing population of the Pacific States, their excellent and increasing railway communications, and their comparative isolation from the great naval powers, hostile operations directed against the United States upon the Pacific slope will be almost exclusively confined to sea and coast operations by naval forces, aimed at our seaports for the control of our waters and the immediately adjacent territory and against our seaborne shipping both foreign and coastwise. The means of offense being almost exclusively naval, the means of defense must be the same, with fixed defenses for the coast ports of importance. The command of the sea on our north Pacific coast and the waters of the western basin of the north Pacific should be in our hands in peace and war-time. This can only be effected by readiness of a proper and sufficient naval force either on the spot or to be furnished from the Atlantic through an untrammeled Canal. In addition to this, and available for combination, should be the available forces normally attached to the Philippines and the waters about China, Japan and Korea. In other words, the Pacific Ocean from Samoa northward should be within our control.

To the vessels in commission should be added others in reserve at the two naval stations. An intelligent policy of combination and development should be followed as to these two stations, and the predominating natural advantages of each station should be utilized and no attempt be made at enormous expense to force conditions at one station which naturally exist and are presented at the other. Especially should it be remembered that the disadvantage of a diffusion of resources does not apply to drydocks, for next to an actual want of docking appliances upon a sea coast is a want of proper and geographical distribution of these facilities. No naval stations of the United States should exceed in plant and supply of stores those upon our Pacific coast, for added to their importance are the disadvantages arising from their distance by land and water from the great manufacturing sources of purely naval material.

That the Aleutian Islands afford secure harbors for coaling stations, the Behring Sea trade and the greatly increased Yukon traffic have shown. These stations are also available as well for China and Japan by the northern routes.

Of the Hawaiian Islands but little more is needed to be said. Their value is evident as a stepping stone to Guam and the Philippines and by the southern route to China and Japan. They are the only group north of the equator with excellent harbors and with both natural and artificial resources, and capable of being self-supporting in case of blockade or isolation in time of war. They have some resources as a port of repair and coaling, and a cross-roads on the Pacific for steamer lines east and west and north and south.

In leaving the north Pacific Ocean to discuss the southern Pacific at the risk of repetition we will say that a predominance, both maritime and naval, in the north Pacific Ocean is an essential matter for the United States in regard to the interoceanic Canal. As the want of such naval predominance in the Caribbean would deny us access to the Canal on that side in wartime, so a similar want of naval predominance in the Pacific will prevent our ships gaining access to the Canal from those waters. The maritime preponderance in the north Pacific, though contested, is still ours, and to this should be added the naval predominance which, if it does not precede the maritime predominance, should at least accompany it. Such naval predominance and control would include—

1. A control over our own coast and especially over our northwestern water frontier.

2. A control of the waters about the Pacific terminus of the Canal.

3. A control of the Hawaiian group.

In the southeastern Pacific we have the Latin-American countries of Colombia, Ecuador, Peru and Chile; Chile alone being of any naval strength, which is needed for her own and neighboring waters. It is not likely that these countries will enter into any entangling alliances with European powers and thus offer them the vantage ground of an American port for a base of naval operations. It is of course not improbable that unfrequented portions of the coast may be used for purposes of coaling notwithstanding the violation of neutrality involved; but this would only be temporary and to some degrees alone better than coaling at sea, for there are few places that are uninhabited and free from the Pacific swell. There is always danger, it is true, that a group of islands as well placed as Galapagos Island, acquiring new importance by the opening of the Canal, may be secured from Ecuador by some European power; but even if this were done, its rôle would be more of a port of coal or coaling than a port threatening the Canal. It would be on the flank of the south Pacific routes, but not in a vitally important position so far as we are involved in the matter. Whether the Monroe Doctrine would here be applicable would rest with our statesmen and with the light of our latter-day history upon the matter.

The islands and countries of the southwestern Pacific of any importance are in point of nationality, Samoa excepted, either French or English.

The French islands of the mid-south Pacific are centered about Tahiti and its principal port of Papeiti, which is both the political capital and the headquarters of the French naval division of the Pacific. In addition to the Society group, of which the island of Tahiti is the principal and most important, the French either control or definitely possess the Marquesas group, a rendezvous used by Commodore David Porter in the war of 1812, most of the islands of the Low Archipelago and of the Austral group, which latter includes the well placed and good harbor of the small island of Napa. In fact, Napa is all harbor, and as the island is midway upon the great circle route between Brito and Australia, it might well become of importance as a coaling port upon the opening of the Canal. Tahiti, however, has a certain amount of resources which Napa wants; and it has certainly a mid-ocean position, nearly equidistant from San Francisco, and Sydney in Australia, and about 2400 miles from Honolulu, Auckland and New Caledonia. It has, besides the port of its capital Papeiti, an excellent natural harbor in Port Phaeton on its southern side, which may, if occasion requires, be further developed by the French for naval purposes.

The Samoan islands are nearly midway between the Hawaiian islands and Australia. The island of the group with which we as Americans are most concerned is that of Tutuila, in which is the harbor of Pango-pango. Of all the anchorages of the group this is the best, and it presents a very considerable anchorage area, so far sheltered as to be safe at all times, and presenting a depth of water sufficient to accommodate vessels of war of the largest class. It is on the flank of the trade-route to Australia and New Zealand, and is a valuable strategic point for the whole southwestern Pacific.

Commercially, this harbor or island is not likely to have great importance unless made a free port. Tutuila presents few resources, and the harbor, which is on the south side, extends inland to so great a distance as to almost cut the island into two parts. The harbor is so landlocked and protected as to have the quiet of a mountain lake, could be strongly defended, and is practically unobstructed.

With the wealth of the group upon the neighboring island of Upolu, with the best harbor on the almost unproductive island of Tutuila, and with three great naval and commercial powers striving for a predominant influence in the group, the Samoan question is a mixed one. To this complexity of the question is added the sentiment arising from the vessels and lives lost and the blood shed directly and indirectly by the present status of the question.

Certainly it would be the wisest policy to have the whole group under the protectorate of one power; if that cannot be realized and the United States desires to include the southern Pacific within its sphere of influence, then Pango-pango and its island should be fully acquired, developed and fortified. As a coaling station for peace time only, it is unnecessary and expensive. Without defenses, its rôle as a coaling station in a naval war seems absurd, as it would become either a burden to the fleet or an easy objective to any cruising vessel of the enemy.

The Fiji Islands and New Caledonia, though bearing certain relations towards each other and towards Australia and New Zealand, bear little in a naval sense towards the Canal. New

Caledonia, a French colony, is too far from Tahiti to permit any unity of action or mutual support between the two colonies.

The Fijis, offered more than once to the United States and Great Britain, were finally accepted by the latter country. There are some good harbors and the sugar product is considerable, but these islands are not likely to play any important part in a sea so thoroughly commanded by their rulers.

The study of Australia, with which for the moment I will include New Zealand and Tasmania, is interesting from a naval and commercial sense and as presenting a country newer than our own but developing under different conditions and upon different lines from the United States. The population of Australia is singularly homogeneous in its white men, being over 90 per cent. of British origin. Two peculiarities in the distribution of this population is of interest in connection with naval and military matters; the first is that all of the large cities of Australia are seaports, and the second is the very large proportion of the population residing in the cities. The agricultural population is sparse—the cities overcrowded. The two largest colonial cities of the British Empire are the Australian cities of Melbourne and Sydney, and these two with the city of Adelaide contain one-fourth of the entire population of the continent.

Australia may be considered as self-supporting so far as food supplies are concerned, but its purely military supplies come from Europe with the exception of some ammunition made at Melbourne. Both naval and military stores are, however, being accumulated in the principal ports, where excellent drydocks of large size now exist. Coal, that essential naval material, is found in New Zealand and New South Wales, abounding in the latter place, the New Castle mines near Sydney being the source perhaps of the greatest supply found upon the Pacific.

The high rates of wages cause much limitation in the way of manufacturing, and the comparative cheapness of sea transportation, carried on yet to an extent by sailing vessels, further retards development in that direction.

The local military force in the way of partly-paid and volunteer militia, in Australia alone, numbers about 50,000, and these can be readily concentrated at the large cities by rail or sea. To the regular Imperial British naval force on this station is added an Australian Squadron created by a mutual agreement and colonial payments. In addition there is a naval militia in the state of formation.

The objects of the Australian Squadron were announced as—

1st. To provide a defense against attacks from armored vessels with ships of equal or greater power.

2d. To provide for the defense of commerce by cruisers of the latest type.

3d. To have in reserve in the colonies in the older corvettes, officers and crews to man the mercantile cruisers which would be employed in time of war.

4. To carry out the policy of the Pacific.

There are five places in and about the three Australian divisions that present themselves as important naval positions. They are Sydney, King George Sound, and Thursday Island in Australia proper, Auckland in New Zealand, and Hobart in Tasmania.

Before closing this brief study of the Australian Colonies, now partly federated, it would be well to call attention again in a military sense to their isolation and distance from European and Mediterranean waters. From Suez to Aden in the Red Sea the distance is 1310 miles, while from Aden to King George Sound in Southwestern Australia the distance is 4970 miles, while to Thursday Island off the north coast of Australia the distance is 5970 miles. From Sydney to San Francisco the distance is 6430 miles, while to Vancouver the distance is 6840 miles. In these days such distances are ignored on account of ready telegraphic communication, but fortunate it is, in a military sense, that so large a country, yet so greatly dependent upon the sea and sea communication, should have as a generous and indulgent mother country, one whose command of the sea is so universal and so undoubted.

The military and naval features of the Philippines is a subject of such every-day discussion that it hardly needs to be entered into. With the pacification of the country the present disproportionate attention to this group in a military and naval way will cease. With its retention under our government and flag will come of course a certain amount of naval importance and development. The station at Cavité will be retained undoubtedly until our naval rôle for the future is thrashed out, then if our requirements demand a station of security, defensibility and importance independent of the resources of Manila, Subig bay seems to be the choice of those whose investigations and personal experience make them capable of judging.

The relative importance of the Philippines in the extreme East depends very much upon what rôle we are to assume or to be left to undertake in China. Whether we will advocate the open door in its full meaning or whether we will accept a territorial domain from China with its sphere of influence, is a matter concerning not only our trade relations but our naval position. If the latter policy be adopted then there will be a northern coaling and naval station to balance that of the Philippines and the value of the Philippines station will be decreased. If, however, we should seek for trade without using territory as a means we will center our naval resources in or about the island of Luzon and place there a coaling station, a repair station and a drydock of the largest size. We cannot depend upon the drydocks of Hong Kong in case of war.

There are, it is true, harbors either really or practically detached from the mainland along the coast of China and Korea that might be secured as coaling stations and made part of our territory for that purpose They might in time serve as trade centers, although primarily used for other purposes. These places would either require fortification or a probable command of the sea on our part in any war which we might be called upon to enter in these far-off waters. Hence, the acquisition of such territory should not be entered into lightly and all of the contingencies likely to follow should be carefully examined. Climatic, geographical, and trade reasons seem to favor a northern port, but if this acquisition should not be made, then the Philippines will serve our naval needs and a periodical change of climate should be made and followed rigorously as a routine necessary for the vessels of the United States in these waters in times of internal and external peace.

We will now consider the political conditions of the countries affected by the opening of the Canal and discuss their relations towards the United States.

Recommencing with the West Indies we find that the former Spanish Colonies of Cuba and Puerto Rico, now in our possession are, intrinsically and strategically, the greatest in value and importance of all the countries included within these regions.

Their population exceeds two millions; and the position of Cuba alone places these former dominions of Spain in a position of the highest importance towards the United States. Whatever may be the future political condition of Cuba, care should be taken that it should never be, by the possibility of an entangling alliance with a strong naval power, a menace or a source of danger to the United States. So conservative a stateman as John Quincy Adams is quoted as having often said—and we were a weak nation at that time—that we ought to make war upon the greatest naval power of the world rather than allow her to acquire Cuba.

Excluding the Bahamas, the British Colonies of the West Indies have a population of over a million, of which only about 3 per cent. or over 30,000 are whites, the remainder being either black or colored with mixed blood, and Chinese and Indian coolies. The decrease of white population is apparent from the fact that Jamaica two hundred years ago had 70,000 whites, while now it has about 15,000.

It may not be too discursive, in examining the British West Indian Colonies, to refer briefly to the forms and methods by which the Colonial Empire of Great Britain is administered.

The English Colonies, politically, can be divided broadly into three classes (India and the newer territories being excluded), as follows: 1st. The Crown Colonies; 2d. The Colonies where representative institutions exist in part or wholly, but where the executive and administrative power remains with the Crown; 3d. The Colonies possessing both responsible government and representative institutions.

1. The Crown Colonies, in general words, are those in which the Crown exercises a full control upon the legislation, and where the Colonial administration is carried on by officials appointed and controlled by the Home Government. Of the Colonies likely to be within the field of the Canal, Jamaica, Tobago, Trinidad and British Honduras or Belize and the Fijis are purely Crown Colonies. In Crown Colonies generally the white race is an insignificant factor of the population.

2. In the Colonies which possess representative institutions but no responsible government, the Crown cannot, as a general rule, legislate by order in council, the laws being made by one or both of the legislative houses with the concurrence of the

governor. At least one of these legislative houses is entirely, or in greater part, representative. Besides the veto power and the control of the executive, the Crown retains the power of appointment of the public officers.

There are several variations of this type of Colonial Government, such as that existing in the Bahamas, the Windward Islands and Barbados, where there is a council named by the Crown and an elective assembly in addition. In the confederation of the Leeward Islands there is one legislative house only, part elected by the people and part being named by the Crown. The whites are in a minority in the countries where this type of government prevails.

3. The Colonies possessing a responsible government and representative constitutions are not under the control of the Crown or Imperial Government beyond the appointment of a constitutional governor as representative of the Crown and a veto power upon legislation, which is rarely exercised. The Australasian Colonies (except Western Australia) and Canada, of which British Columbia is a part, are within the scope of this examination. It is hardly necessary to say that the population of these Colonies are almost wholly whites of European race and origin. A federated form of government is found in some of the Colonies of both the second and third classes.

The term of the Governor is at the pleasure of the Queen not to exceed six years. The Governor is not, unless especially invested, in direct command of the regular forces of the Colony. The Home Government for evident reasons takes exclusive charge of questions concerning the relations of the Colonies with other foreign powers, no matter how free the Colony may be. This includes the conclusion of treaties and conventions, naturalization, declaration of war and peace, and all military and maritime agreements. In noticing the complexity and variation of the English Colonies we must be led to realize its resulting flexibility, knowing as much as possible in essential matters the characteristics and customs of the various races with which it deals, and showing in part the reason which makes the English, par excellence, the most successful of all colonizers.

The French Colonies in the West Indies, termed by them—the French Antilles, consist of Guadeloupe, Martinique and the smaller islands pertaining to Guadeloupe. Martinique and

Guadeloupe form separate Colonies, each having its own government and, unlike the British Colonies, having representatives in the Senate and Chamber of Deputies at Paris.

The French Colonies have been classed in two groups—

1. Those which are endowed with representative institutions by which all local financial questions are decided; all organic laws or changes requiring the consent of the French Senate. The command of the forces and the internal administration is in the hands of the Governor appointed by the Home Government, who has under his orders all of the functionaries, including those of the army and navy. Martinique and Guadeloupe are of this group.

2. Those which have no general council or representative body, delegates from the municipal councils taking the place of this body by sharing in the discussions of the Privy Council. Tahiti and New Caledonia are of this group.

Of the other European Colonies existing in the West Indies which come within the direct scope of the Canal only St. Thomas and Curaçao can be considered important, and they are important only on account of their harbors and good geographical position.

The governments of Santo Domingo and Hayti, republics in name, are so unstable in their nature and so irregular and erratic in their administration of affairs that their nominal constitutions or political governments are not worthy of study. Of black and mixed race, their inhabitants range from an approach to civilization to but a few removes from barbarism.

The Central American countries, however, deserve a closer study on account of their close proximity to the interoceanic water-route. They are unfortunately of that type of Latin-American nationality with which we of the Navy are so familiar. On paper and theoretically they are republics and complete nationalities; as a matter of fact they lack the full powers and strength of stable sovereignty and it is a question if they really desire a full recognition of their rights as to national privileges and complete jurisdiction over their citizens in times of revolutions.

Geographically, Central America proper borders on the Pacific and the Caribbean and stretches from the State of Chiapas in Mexico on the north to the Department of Panama in Colombia on the south, being in length about 900 miles, with a breadth varying from 30 to 300 miles and an area of 175,000 square miles. Both seacoasts are low, hot and comparatively unhealthy, the Pacific Coast being the better of the two and the more thickly populated. In the highlands of the interior the heat, however, is seldom oppressive, the climate varying with the elevation, which is so diversified as to give rise to the statement that no country in the world presents a greater variety of climate upon an equal extent of surface.

The political history of the Central American republics since the viceroyalty of Guatemala was terminated by the overthrow of the Spanish rule, has been one of attempted union, first with Mexico and then with each other, varied by internal revolutions and external wars between the several states. All attempts of permanent federal union have been unsuccessful and it is the opinion of the most enlightened public men of Central America that any union will be possible only when personal and revolutionary governments shall have ceased to exist in these separate countries, and when alternation in power, under constitutional law, shall have been established for several successive periods in all of the Central American States. With this deliberate and well digested opinion added to the historical experience of the past, we can only add the opinion, founded upon personal observation, that Central American union from internal action is neither possible for the present nor probable for the future. As a result of the present political state in Central America, with small, weak and unstable States, jealous and warring against each other, there exists a great want of development in their valuable agricultural, mineral and commercial wealth.

Practically, there are no manufactories, while the absence of roads and the difficulty of communication make mining unprofitable and commercial interchange difficult. This want of facilities for intercommunication militates against any extensive intermingling of the people and consequent political union.

Although the Central American States have written constitutions, in the main copied from our own, providing for popular representative institutions and peaceable changes of government, their internal history is one of constant strife towards their neighbors, and revolutions and dictatorships at home.

Various attempts have been made at white colonization along these coasts under the official cognizance of the various Central American republics by European companies without any permanent results, notwithstanding the desirability of the high lands in the interior for residence by the white race.

The international questions between the United States and the various Central American republics have been various and many, the most important ones being due to the question of transit and the construction of an interoceanic Canal through Nicaragua, and the proposed or threatened acquisition of various portions of Central American territory at Belize, the Bay Islands, and in regard to the protectorate existing over the Mosquito Reservation. In addition to these questions, there has been the attitude of the United States, as a friendly and neighboring nation, as mediator between Mexico and Guatemala, and with the Central American republics individually and collectively in regard to their union as one nation.

The water-route afforded by the San Juan river to the lakes of Nicaragua early attracted the attention of some of our countrymen, and the Atlantic and Pacific Ship Canal Company was formed and secured a charter from Nicaragua August 27th, 1849, over fifty years ago. This charter for a ship-canal met with a serious obstacle at once on account of the claim to the whole eastern coast of Nicaragua by the Mosquito Indians, over whom Great Britain then exercised a protectorate. Although this claim was not recognized by us, still any attempt to force a canal through this territory would have caused difficulties two serious to allow of the commencement of such an enterprise. Hence, Secretary Clayton, of our State Department, requested the British Government to withdraw all claim to this coast so as to permit the construction of a canal under the joint auspices of the United States and Nicaragua. This was declined, but the British Government agreed to enter into a treaty for a joint protectorate over the proposed canal and water-route. From the negotiations and correspondence which followed upon this subject arose the Clayton-Bulwer treaty, which was made in Washington, April 19th, 1850. This treaty is remarkable as being the only case in which the United States ever allowed itself, so far as I know, to join with any European power in the arrangement of political matters upon the American continent, and it is especially singular that it undertakes to settle a question more important to the United States than any other likely to ever arise outside of its own territory.

The most important article in this treaty is the first which reads as follows:

"The Governments of the United States and of Great Britain hereby declare that neither the one nor the other will ever obtain or maintain for itself any exclusive control over the said ship-canal; agreeing that neither will ever erect or maintain any fortifications commanding the same, or in the vicinity thereof, or occupy, or fortify, or colonize, or assume or exercise any dominion over Nicaragua, Costa Rica, the Mosquito Coast or any part of Central America; nor will either make use of any protection which either affords, or may afford, or any alliance which either has, or may have, to or with, any State or people, for the purpose of erecting or maintaining any such fortifications, or of occupying, fortifying, or colonizing Nicaragua, Costa Rica, the Mosquito Coast or any part of Central America, or of assuming or exercising dominion over the same; nor will the United States or Great Britain take advantage of any intimacy or use any alliance, connection, or influence that either may possess, with any State or Government through whose territory the said Canal may pass, for the purpose of acquiring or holding, directly or indirectly, for the citizens or subjects of the one, any rights or advantages in regard to commerce or navigation through the said Canal which shall not be offered on the same terms to the citizens or subjects of the other."

The other articles provide for the common use in war-time of the Canal, its neutrality, the protection of the parties and properties engaged in the construction of the Canal; the use of influence with other States to facilitate the construction of the Canal, and for the invitation to other States to join in the participation of the rights and guarantees.

In the second article, which provides for the neutralization, or rather freedom, of the Canal, the reading is as follows: "Vessels of the United States or Great Britain traversing the said Canal shall, in case of war between the contracting parties, be exempted from blockade, detention or capture by either of the belligerents, and this provision shall extend to such a distance from the two ends of the said Canal as may hereafter be found expedient to establish."

In the eighth article is found the singular provision which extends this treaty over any other interoceanic canal or railway at Tehuantepec, Panama, or any other part of the isthmus connecting North and South America. This provision was made notwithstanding the existence of a special treaty in full force with New Granada (now Colombia) and the United States which had been made in 1846, and which will be discussed later. Notwithstanding the Clayton-Bulwer treaty and its requirements, Great Britain did not formally relinquish her dominion over the Bay Islands until 1859, and her protectorate over the Mosquito Indians until 1860, and Belize is still a British Colony. It is, however, fair to say that when the ratifications were exchanged both Mr. Clayton and Sir Henry Lytton Bulwer declared that the question of Belize was not included in this treaty; but this is not shown in the body of the treaty as duly confirmed by the Senate of the United States.

In 1867 a treaty was concluded between the United States and Nicaragua which guaranteed on the part of the United States the neutrality and innocent use of any transit route through Nicaragua, and extended the protection of the United States over the same. This treaty gives to the United States and to their citizens and property, the rights of interoceanic transit over any route now existing or to be hereafter constructed, Nicaragua reserving the rights of sovereignty over the same. The United States in their turn agree also "to employ their influence with other nations to induce them to guarantee such neutrality and protection." Nicaragua further undertakes to establish a free port at each terminus of the transit route; gives the United States liberty to carry troops and munitions of war in their own vessels, unless these are intended to be employed against Central American States friendly to Nicaragua, and gives in the sixteenth article additional powers in the following terms:

"The Republic of Nicaragua agrees that, should it become necessary at any time to employ military forces for the security and protection of persons and property passing over any of the routes aforesaid, it will employ the requisite force for that purpose; but upon failure to do this from any cause whatever the Government of the United States may with the consent or at the request of the Government of Nicaragua, or of the minister thereof at Washington, or of the competent legally appointed local authorities, civil or military, employ such force for this and no other purpose; and when, in the opinion of the Government of Nicaragua, the necessity ceases, such force shall be immediately withdrawn."

"In the exceptional case, however, of unforeseen or imminent danger to the lives and property of citizens of the United States, the forces of said Republic are authorized to act for their protection without such consent having been previously obtained."

This treaty was to remain in force for fifteen years and can be abrogated on one year's notice from either contracting party.

The Republic of Colombia, which has a coast line both on the Caribbean and the Pacific, and is an important factor in the Canal question from the fact that the Department, formerly State, of Panama, which includes the isthmus, is within its territory.

On the 5th of August, 1886, a new constitution was adopted and put in effect in Colombia which changed this nationality from a loose confederation of sovereign States to a strong centralized and almost autocratic republic.

The most important of the nine departments of Colombia is Panama, within whose limits is the Panama railway and canal route; the whole length (from east to west) of that department is 360 miles, but the irregularity of its coasts gives 400 miles coast line in the Caribbean and 600 miles on the Pacific. Of the importance of this department and isthmus it is hardly necessary to speak; nor will I recount its past history except to refer to one or two of the most important political incidents, the first one worthy of mention being the Panama Congress. This Congress was called at the suggestion of Simon Bolivar and was to be composed of representatives of all the American republics, for the purpose of counteracting the aggressive movements that were feared from the "Holy Alliance" of several European countries. Much was expected from this Congress, and a resistance was intended to be made to possible movements on the part of this holy alliance to conquer the Spanish Colonies. Deputies were appointed from Colombia, Central America, Peru and Mexico only—with passive delegates from the United States and Holland.

As planned by Bolivar this Congress had originally military as well as political purposes; the military objects were to be the adoption of certain measures to resist any new attack by Spain and France against the Spanish-American republics; the other object being a closer and more cordial commercial and political understanding between the new republics and the United States. The military objects of the Panama Congress were furthered most effectively by an announcement made by President Monroe at this time with the cordial support then of Great Britain. This declaration has since become famous as the "Monroe Doctrine," and was made by President Monroe in his message to Congress in 1823. It reads as follows: "With the existing colonies or dependencies of any European power, we have not interfered and shall not interfere. But with the governments who have declared their independence and maintained it, and whose independence we have on great consideration, and on just principles acknowledged, we could not view any interposition for the purpose of oppressing them, or controlling in any other manner their destiny, by any European power, in any other light than as the manifestation of an unfriendly disposition towards the United States."

The general treaty of Amity, Peace and Commerce, concluded in 1824 between the United States and the republic of Colombia (then composed of New Granada, Venezuela and Ecuador), was the first treaty with the new Spanish-American republics. In 1831, the three countries referred to above became separate, independent republics. During the administration of President Polk, in 1846, a treaty was made with New Grenada which in article 35 includes two guarantees which are most important. The first says that:

"The Government of New Grenada guarantees to the Government of the United States that the right of way or transit across the isthmus of Panama upon any modes of communication that now exist, or that may be hereafter constructed, shall be open and free to the Government and citizens of the United States and for the transportation of any articles of produce, etc., belonging to the citizens of the United States, etc," and, in turn, the "United States guarantee positively and efficaciously to New Grenada by the present stipulation, the perfect neutrality of the before-mentioned isthmus, with the view that the free transit from the one to the other sea may not be interrupted or embarrassed in any future time while this treaty exists; and in consequence the United States also guarantee, in the same manner, the rights of sovereignty and property which New Granada has and possesses over said territory."

This treaty was for a term of twenty years, and to continue in force until twelve months from the time that one of the parties "notifies the intention of proceeding to a reform." This treaty is still considered in force by both nations, though the term of its duration, as named in the body of the instrument, has expired, and it is continued upon the limited basis fixed for its extension, that is from year to year. It has been ruled by our government that though this treaty binds the United States absolutely to guarantee the neutrality of the isthmus upon the demand of the proper party, it does not oblige the United States to defend the isthmus from a body of insurgents against Colombia except so far as to preserve the free transit across the isthmus.

Under the treaty the United States is authorized and required to protect the transit of the isthmus from foreign invasion and authorized to require Colombia to keep the transit free from domestic disturbance. For this purpose the United States can use such military and naval forces as may enable them to assist Colombia to keep open the transit.

It is not necessary to recount the times that the armed forces of the United States have been called upon to interfere to protect the transit across the isthmus. It is sufficient to say that the rights and guarantees given by this treaty have been duly assumed by us, and tacitly acknowledged by the rest of the world.

In 1864 it was feared that Spain would attempt to send troops and munitions of war across the isthmus of Panama to be used against Peru. Although the obligation did not actually arise in this case, the Attorney-General of the United States, to whom the case was referred, decided that under this treaty it was obligatory on the part of the United States to prevent such warlike measures. In 1856, 1868 and 1870 endeavors were made by the United States to make new and additional treaties upon this subject but without final success.

On March 25th, 1878, a canal concession was made by the Colombian Government to Lieut. Wyse of the French Navy, which he in turn, with the consent of the Colombian Government, transferred to M. de Lesseps. Under this concession the Panama Canal was commenced and partly constructed.

Notwithstanding this concession to a corporation mainly composed of foreigners, and their subsequent acquisition of the Panama Railroad (which still remains, however, nominally an American corporation), the Government of the United States considers that its treaty obligations remain the same. President Hayes said in 1880: " Without urging further the grounds of my opinion, I repeat in conclusion, that it is the right and duty of the United States to assert and maintain such supervision and authority over any interoceanic canal across this isthmus that connects North and South America as well as protect our national interests." Secretary Evarts further announced to our minister to Colombia in 1880 that: " It is, however, deemed prudent to instruct you with all needful reserve and discretion, to intimate to the Colombian Government, that any concession to Great Britain or any other foreign power, looking to the surveillance and possible strategic control of a highway of whose neutrality we are the guarantors, would be looked upon by the government of the United States as introducing interests not compatible with the treaty relations which we maintain with Colombia."

President Cleveland said, in referring to our action in 1885 in sending a force to open and guard the transit after the burning of Colon: " The prompt and successful fulfillment of its duty by this Government was highly appreciated by the Government of Colombia, and has been followed by expressions of its satisfaction." The performance of this duty by the naval forces of the United States in 1885, while the canal was in process of construction by a French Company, was in the presence of English, French and Chilean naval forces, who were silent witnesses of this action of the United States, tacitly acknowledging the primary responsibility of the United States in the matter.

The dispatch by the Navy Department in 1880 of the Kearsarge to Chiriqui lagoon and of the Adams to Golfito in the Gulf of Dulce, for the purpose of establishing coaling stations or of investigating the advisability of so doing, led to considerable excitement in the State of Panama and in Colombia generally. The Colombian Government disclaimed any unfriendly intention and our Government withdrew the ships from these places, or at least was enabled to announce the fact of their withdrawal, at the same time stating that, " this Government was aware that the acquisition of such places, whether by purchase of private property, or by public grant, would need be brought to the notice of the Colombian Government, and it has never entertained a doubt that its assent would be cheerfully given."

In answer to a proposition from Lord Granville, then English Minister of Foreign Affairs, that the American Government should invite other powers to participate in an agreement based upon the Clayton-Bulwer treaty to protect or guarantee the neutrality of the Panama Canal route, Secretary Frelinghuysen, in declining, stated that the President of the United States believed that the formation of such a protectorate over the isthmus transit would be in conflict with a doctrine which had been asserted by the United States for many years.

The countries of South America, both on the Caribbean and the Pacific Ocean, not already mentioned, have but a remote political relationship with the questions clustering about the Canal. The closeness of the commercial relations existing between these countries and England and Germany give rise to more intimate politico-commercial interests between these countries than exists generally with the United States. The Pan-American conferences and the recent undertakings in the way of an expansion of trade to the Latin-American countries give evidence of closer relations yet to come in the way of trade and, so far as trade and mutual dependence is concerned, in the way of a common and harmonious policy. Certainly, the more intimate communication resulting from the opening of the interoceanic Canal will lead to closer political relations without affecting in any way the independence of action and policy of these countries.

The countries in the western Pacific, like Australia and New Zealand, are English Colonies with the freedom of trade and regulation of trade that pertains to all of England's possessions. The other countries to be considered are China, Japan, Korea and Siberia. The manifest interests of this country lie with the policy of an open door, and already large shipments from the United States are made to all ports, directly or indirectly, extending from Vladivostok in the north to Singapore in the south. It is hardly probable that the trade of Russian China and Korea will be fettered beyond that of the home country of Russia; and for China itself our trade interests, so steadily growing of late, will compel a political policy on the part of our Government for as much freedom of trade at least as we give to the European world. An entanglement in the struggle for supremacy in China and Korea will probably be avoided by our country except to establish the proper amount of freedom in trade. With the islands of the Pacific our policy should be the same. It is our duty to prevent the Pacific Ocean from becoming a sea in which American commerce is restricted or made in any way hostile to American trade.

In reviewing, finally, the existing and probable conditions surrounding the Canal question, let me recall to your attention again the military and strategical importance of the waters and islands of the Gulf of Mexico and the Caribbean Sea. The islands which border the various routes to the Canal through these waters are held, with the exception of Cuba, Hayti and Puerto Rico, by European powers, and their political affiliations are foreign to us. The fact that the use of the Canal can be prevented by a naval predominance in the Caribbean has been called to your attention repeatedly. It is not necessary to go to the Pacific when the control of the Caribbean, so readily accessible to Europe and the United States, will close the Canal to the world. As an accessory to this control the islands in the possession of France and England would serve as natural bases and coaling stations. An element to be considered, however, is the one that these insular countries, though now foreign to us, are being drawn daily by their commercial interests to a closer relationship to the United States. This fact will not fail in time to affect their political relations with us, as political interests, in this material age, are gravely affected by commercial interest, and in this case by the fact that the United States, from their wealth, great population and proximity, furnish to the countries of the West Indies the great market for their products, especially sugar, tropical fruits and tobacco.

As to the Central American States, so near to the future ship-canal, we find here such evidences of political weakness externally and internally, with so little prospect of change for the better in the future, that the consideration of other and stronger nations upon them cannot be avoided. As an evidence of their weakness let me refer to the fact that the conquering race in America—the European whites—number now in their pure descendants less than one-third of the population, and that the remaining two-thirds consist of unwarlike Indians or degenerate mixed races. And even Costa Rica, with its larger population of whites, is no exception to the rule of weakness and instability.

I have said that in my opinion no security, stability or strength will ever come to these Central American countries collectively or individually without either external assistance or a general colonization. It is more than likely that the Nicaragua Canal, when built, will bring either one or the other of these to the States immediately about it. To emphasize the necessity, let me recall the fact that Walker, in his filibustering expedition, with but 1200 white adventurers of all nationalities, actuated by no lofty or national sentiment, made himself master of Nicaragua and continued so, even after he had cut off his supplies of men and material by his blundering quarrel with the Transit Company; and another striking instance in Costa Rica, when a squabble between two mercantile houses about legislation for a railway, led to an overturning of the government by a revolution caused by a force of sixteen men concealed in an ox-cart. These instances may lead us to appreciate more tangibly the internal weakness of the two States the territories of which will touch and include the interoceanic waterway known as the Nicaragua Canal.

The United States and Great Britain are the two great powers that have by various means exerted the most influence upon the Central American States. This has been more particularly brought to bear upon Nicaragua, Honduras and, to a less degree, Costa Rica, and mostly from matters arising directly or indirectly from the questions of interoceanic transit.

The relations on the part of the United States to these countries have been generally that of a friend and protector. Salvador at one time wished to join our federation; we have been appealed to frequently as a mediator; and more than one treaty has been formulated giving us the right and duty of protecting the sovereignty of Nicaragua and other States. Of all our treaties concerning these countries the most prominent and important one is that with Great Britain, known commonly as the Clayton-Bulwer treaty.

The first great and serious disadvantage which is found in connection with this treaty is the unlimited and perpetual nature of the obligations, the treaty having no limit or time of expiration. The defects of perpetual treaties are obvious; these treaties are now generally condemned and will probably be seldom negotiated in the future. John Stuart Mill, in discussing the subject of such treaties, said that—"Nations should abstain from imposing conditions which on any just and reasonable view of human affairs cannot be expected to be kept. And they should conclude their treaties as commercial treaties are usually concluded, only for a term of years."

The first article of this treaty is open to objection on account of the prohibitions and limitations it places upon the United States—the leading and predominating power upon the North American Continent—and it is especially objectionable because we cannot, by its terms, aid or protect our commerce, and indirectly our Pacific territory, by establishing the necessary coaling stations within the limits of the Central American States or by landing a sufficient force to protect our transit, our citizens, or our trade.

The second article is objectionable because it allows the use and traverse of the Canal by the fleets and vessels of war of Great Britain, on their way, it may be in war-time, to attack our Pacific home coast or insular territory. We are denied by the terms of the treaty the right to detain, blockade or capture such a force no matter how inimical.

The eighth article states, in violation of the Monroe Doctrine as now interpreted, that the two countries, one European, "not only want to accomplish a particular object but also to establish a general principle," which is no less than a protectorate over the other transit routes proposed at Panama and Tehuantepec.

It is safe to say that it is practically the opinion of all Americans that this treaty should either be abrogated or very materially modified. The change of conditions since the signing of this treaty, due to our new West Indian acquisitions and more especially to the great development of our Pacific coast and territory, should cause Great Britain also to see the desirability if not the necessity of this action. The preservation of the treaty and its consequent limitations is not a vital matter to her and her commercial interests and future policy will probably not suffer by the disappearance of the Clayton-Bulwer treaty as a bone of contention between the two countries.

To understand more clearly the present unsatisfactory condition of affairs existing under the three treaties now in force with the United States bearing upon the subject of the Canal, a brief summary will be given of the method proposed in each for dealing with the international relations of the Ship Canal.

In the treaty of 1846 with New Grenada (now Colombia) the United States guarantee positively and efficaciously the perfect neutrality of the whole isthmus of Panama and also the rights of sovereignty and property which New Grenada has over the isthmus. As a single nation can hardly guarantee neutrality this really means protection. At the same time, it is true, Colombia can obtain the same guarantee of protection from other nations, there being nothing but the moral influence of the United States to prevent this or even to prevent after due notice an abrogation of this treaty of 1846.

In the Clayton-Bulwer treaty of 1850, the United States jointly guarantee the neutrality of the Canal, so that it shall be forever open and free, and they further agree to protect it from interruption, seizure or unjust confiscation. In case of war between Great Britain and the United States all vessels of either power traversing the Canal are to be exempt from blockade and detention. The two powers further agree to ask every other country to join them in the above stipulations and announce the desire to establish these stipulations as a general principle.

In the treaty of 1867 with Nicaragua—the Dickinson-Ayon treaty—the United States extend protection to all proposed canal and transit routes in Nicaragua, and guarantee the neutrality and innocent use of the same. The United States also agree to employ their influence with other nations to induce them to guarantee such neutrality and protection. In this treaty provision is made for landing forces of the United States to protect the transit or the lives and property of Americans. This treaty denies the use of the Canal to hostile cruisers by the words, "guarantee the neutrality and innocent use of the same."

The various propositions concerning the use of the Canal in time of war can be placed broadly under three heads, as follows:

1. A neutralization of the Canal in part; but with free access to and through it and its terminals in time of war, to troops, munitions of war, and to vessels of the naval and mercantile marine of the belligerent powers. This neutralization to be

effected by a joint guarantee from all of the great powers, the sovereignty of the country through whose territory the Canal passes being also guaranteed in the same manner.

2. A complete neutralization of the Canal in war and peace. This to include, in time of war, the denial of access to and through the Canal by the troops, munitions of war and vessels of war of the belligerent powers. The guarantee of neutrality to be made by all of the powers, and the country or countries through which the Canal passes to enforce its neutrality with the assistance of the United States as the power most concerned.

3. The absolute control and supervision of the Canal in peace and war-time by one nation—the United States.

The *first* proposition for *partial* neutralization, but allowing the Canal to be used as a free highway in time of war for armed forces is virtually the one agreed upon in the Clayton-Bulwer treaty. As the great naval power of the world, Great Britain does not fear the free use of the Canal by other naval powers, if she has the same right. So far as the Suez Canal is concerned, Great Britain deems it necessary to keep it open for her war-vessels and troop-ships as the shortest route to India, a route which if denied to her in certain contingencies, might endanger her hold upon the Indian Empire. This rule applied to the American Canal would be to our great disadvantage and also to the disadvantage of the comparatively weak nationalities upon the west coast of America.

These latter nationalities, like our own west coast and Pacific islands, would lose the military advantages they possess from their comparative isolation, and distance from the home country and naval stations of the European powers. With the free use of the Canal in time of war and with the naval bases for offensive operations now existing in the West Indies under the control of France and England, these countries could be made to feel to a greater extent the pressure and influence of the European powers. Furthermore, no matter what paper declarations might exist, a canal made a free strait as it were, in time of war would become from the force of circumstances part of a water area whose command was to be secured, and hence become a battle-ground or scene of blockade, useless for commercial or naval purposes in war-time.

The second proposition, providing for a complete neutralization, is practically the same as the conditions prescribed by the treaty of 1867 with Nicaragua. It would deny the use of the Canal to cruisers hostile to the United States, but in time it would prevent the use of the Canal by our own vessels of war, and the transfer in time of war of naval force from the Atlantic to the Pacific and *vice versa*, no matter how vital such a movement may be. It would continue thus all of the military disadvantages that exist, and would be in opposition to one of the great reasons that is urged for the construction of the Canal as a matter of large national policy and self-protection. The possibility of what might occur can be forshadowed in studying the varying programmes of Great Britain towards the Suez Canal, as in 1877, when she virtually threatened Russia with war if she blockaded the Suez Canal; while in 1882 Great Britain herself seized the Canal, held it from end to end and made it a base of supplies and hostile operations.

The third proposition for a canal exclusively owned or controlled by the United States in war and peace means the direct or indirect purchase or construction of the Canal by the Government of the United States. In time of war it would mean a navy of sufficient size and strength to maintain the Canal open against an exterior attack from any power or alliance of powers with the force they can spare from European waters. Local fixed defenses might prevent the occupation of the Canal or its terminal ports, but a blockade at either end will suspend the free use of the Canal upon an occasion when its use might be of the greatest military necessity, and nullify one of the great purposes for which it would be constructed as a national undertaking. It would force the passage of an Oregon or a fleet to be as now through the Strait of Magellan. It has been stated that the Suez Canal has been neutralized in time of war, but this statement is made without a full knowledge of the present status of the matter and certainly in face of the actual passage through the Canal of a belligerent force in the late war with Spain under Camara aimed at our fleet in the Philippines.

The status of the Suez Canal is as follows: On the 29th of October, 1888, a convention was drawn up and signed at Constantinople by nine of the European powers to make free the Suez Canal in war and peace to all vessels, public and private, belligerent or neutral, without distinction of flag. The free use of the Canal was not to be interfered with by the parties to the convention even by the exercise of the right of blockade. No act of hostility was to be committed within the limits of the Canal nor its terminal ports nor within a radius of three marine miles from these ports, even if the Ottoman Empire or Egypt should be one of the belligerent powers. The Canal was to be under the same general conditions as a neutral port with respect to the stay or sailing of opposing belligerent vessels. The Sultan of Turkey or Khedive of Egypt, however, were to be free to use the Canal for military purposes when the defense of Egypt or the maintenance of public order required it.

Great Britain, as a party to this convention, only agreed to it subject to a very important reservation, which was that the application of the rules of the convention was not to embarrass or fetter the liberty of action of the British Government during the period of the occupation of Egypt by the forces of the Queen of England, which period was referred to as a "transitory and exceptional" state of affairs. As this state of affairs is indefinite in its limitations, so the reservation is indefinite, and owing to this fact the terms of the convention have not been brought into practical operation, and the status of the Suez Canal in war or peace is practically what the British Government chooses to make of it.

Let me call attention to a few of the naval aspects of this question. The first thing that presents itself in connection with the canal and our profession is the necessity for a strong naval force for the United States. Separated as the Canal and its immediately adjacent territory is from the territory of the United States by Mexico, the approaches to the Canal require naval protection in order to give us the status here that Great Britain enjoys at Suez. Nothing would conduce more to the safety and protection of these Canals and the beneficent flow of the commerce therein than the control of the Suez Canal by Great Britain and the control of the American Canal by the United States.

It has been said that the changes forced upon us by the Canal will be so great that it would be better for us if no canal were to be built. I do not believe it to be so, but it does not matter; the Canal is inevitable and its eventual opening is but a question of time. We have contributed towards the solution of the question by our official surveys, and have allowed the Panama Canal to be begun and partially constructed. The completion of a great Ship Canal, aided to a greater or less degree by us, will cause a still greater remove from our former policy of isolation from the affairs of the other great powers of the world. The great commerce coming from European maritime countries, passing on its way to and from the Canal near our Gulf territory and West Indian possessions, will revive to European countries the importance of their West Indian Colonies. It will bring these Colonies in even closer relations to us than they have been drawn of late years, creating and reviving through them many questions in which we will have either joint or antagonistic interests with their home governments.

It will be neither reasonable nor possible to debar or restrict certain European interests and rights upon and along these waters in connection with their trade through this water highway of the world.

The questions that will arise about the Canal will be almost exclusively maritime and with the great naval powers. To meet these powers with any tone of strength or pretence of equality in these matters we must have a competent naval marine; or otherwise we will experience those interpretations of international law that are reserved for the less vigorous nationalities and the weaker naval powers.

To perform the duty of protecting and keeping the Canal open to the commerce of the world, as well as the imperative duty of protecting our own trade, a competent naval force is essential. In other words, a naval predominance in these waters is essential; for after all no matter what treaties exist or are made, the control of the Canal will rest with the nation having control of the Caribbean Sea.

For this naval force there must be naval stations in the Gulf of Mexico and the Caribbean Sea to furnish facilities for coaling, docking and extensive repairs to ships and machinery, and also to serve as depots for military and naval supplies of all kinds. To accomplish the naval duty which has been thus foreshadowed, in addition to the increased demands made upon us by our distant acquisitions in the Pacific, means more rapid progress and more actual work in the increase of the Navy. There is no royal road to the construction of a modern and efficient Navy, and Acts of Congress with limitations that make them a nullity keep us behind while others are stirring and progressing. With our great wealth, ample resources and prosperity, this naval increase can be made without strain, and thus possible humiliation and disaster averted in the future.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EXPLORATIONS IN ALASKA.

By George M. Stoney, Lieutenant, U. S. Navy.

(Continued from U. S. Naval Proceedings, No. 91, page 584.)

VIII.—The Notoark River.

From the reports of the two expeditions to the Notoark river, my own in December to the upper valley, and Mr. Reed's from below, the following description is made.

The Notoark, or the Inland river of English charts, rises in the same chain of mountains as the Putnam, Allashook, and Colville rivers. The head waters of all these rivers are not ten miles apart.

Like the Putnam, the Notoark has a delta, not so extensive, but very much like it; through it flow the five outlets of the river (only three of which are worthy of notice) which empty into Hotham inlet on the northern side near its connection with Kotzebue sound. The two most easterly outlets carry two fathoms over the bar; the most eastern, though narrow and winding, has little current. The mouth of the western branch is the widest, but yet has the strongest current. The inhabitants are not so numerous as on the Putnam; a few families live on the delta, and others in scattered villages around the headwaters. The many deserted villages on the lower portion of the river show that the natives are following the deer into the mountains. Its general direction is parallel to the Putnam from which it is separated by a range of mountains 3000 to 4000 feet high. The mountains on the northern side of the valley are less regular and not so continuous. The tributaries are few and unimportant. The river is full of sand bars and islands making navigation difficult; it is generally narrow, until about sixty-five miles above its mouth, when it opens out to greater width for twenty miles up and becomes dotted with innumerable sand bars and islands. Here many hair seal come to breed where they are never disturbed by the natives. The channel is narrow and crooked, and the current rapid, to within fifty miles of the mouth, and when the river is swollen from the rains it is impossible to stem it; when the water is low it can be ascended since a foothold can be had for tracking. Although this river is like the Putnam, the current is much stronger, but both rivers are so affected by the height of the water that no approximate strength of current could be determined.

The Notoark valley is like the Putnam valley consisting of rolling tundra land with many high hills, interspersed with numerous lakes. The growth of timber, grass, etc., is also similar one hundred and fifty miles up; then the spruce and birch disappear and there remains only a scant growth of dwarf cotton-wood, willow and alder.

The Selawik River and Lake.

Selawik lake was first explored in 1884 by Ensign Purcell of my second expedition as described in his report. During the winter I explored the upper part of the valley with a party from Fort Cosmos. On July 16 I left Camp Purcell with a party to complete the work, which we did in eight days. The results of these expeditions are given on the chart and in the following summary.

The Selawik river rises in the mountains south of the upper Putnam and flows west to Selawik lake. Its valley is rolling but less so than the Putnam's and is interspersed with more lakes. The river is not so long as the Putnam or the Notoark, and its course is more winding. The current at the place where the river forks is .8 knots, and less lower down. Many tributaries enter from both banks; they are deep but of no great length. The banks of the Selawik are as regular as canal banks. Two fathoms can be carried up to the fork where there is a five-fathom hole; beyond, the water of the forks was too shallow for the "Explorer."

There are three outlets into Selawik lake; the westernmost is the deepest, two fathoms can be carried over this bar; over the others only a few feet. There is a fourth outlet into the smaller lake "Inland" to the eastward of Selawik lake which is very shoal, not having over three feet of water in the deepest places and for the most part but one foot. There is every indication that this second lake was formerly part of the Selawik lake. Selawik lake itself is very regular in shape and depth. There is little animal life in it; it was dredged for hours, but no specimens were found.

On the Selawik river a little spruce grows in small clusters; more of it is found on one of the northerly branches. The principal growth is of willow and alder, the latter attaining considerable size. The river and lake were triangulated from July 17 to 24. The work was comparatively easy as the same mountain peaks used on the Putnam were visible from the Selawik.

Expedition to Jade Mountain.

On my first visit to Hotham inlet I noticed that the natives had a great many implements made of jade stone, and one man had a piece in the rough state. I inquired where they had gotten it and was told "on the big river" meaning the "Putnam" for which I was searching. When I discovered the river, and again asked about the jade, I was told it was further up.

On my second visit, the mountain where it was said to exist, was pointed out from the river, but the natives refused to accompany me to it, saying that they would never return—that only the medicine men could visit it, and then not until after a long fasting. I tried in every way to get at least one of them to go but without success. One man finally pointed out to me the best route, and I decided to take one white man and go anyhow.

On reaching the mountain I saw a green stone in large quantities; but it was so tough that only with the greatest difficulty did I succeed in chipping off some specimens with a cold chisel. These specimens were sent to the Smithsonian Institution, but proved not to be jade. In conversation afterwards, Professor Spencer F. Baird, then at the head of the Institute, told me that if I could find the jade deposit it would be one of the great discoveries of the age. So on my third expedition I determined to make a special effort to find it.

On July 27, 1886, I left Camp Purcell, Pipe spit, in the "Explorer" to visit the group of mountains which I had named Baird and find the jade stone. I went up the Putnam to the point nearest the mountains, left the "Explorer" and started overland. The expedition consisted of myself, two white men, five natives, and three days' rations. The walking over the tundra was severe and the mosquitoes terrible both day and night. Owing to the recent rains the creeks were very much swollen and the party was obliged to swim across one. This stream, about thirty yards wide, was running at the rate of five or six knots in the middle with still water along the banks. I made a raft of theodolite legs and tent poles; and to make it more buoyant inflated our skin boots and tied them all around it. I then made a tow-line of all the odds and ends at hand, straps, ropes, etc. Those who could, swam over, temperature of water 38° F., the rest were rafted across, as were the stores, tied up in a rubber blanket. Later on, we forded another creek in water up to our waists. Much of the walking was through water knee deep.

On August 1, I reached the mountains and spent two days digging and looking for the jade. The entire spur of mountains was of green stone and amongst it I found the jade. I also found asbestos in the strata of the rocks. I saw only a few marks that indicated visits of the natives. I got a round of angles from near the top on one of the mountains. On the return, the coal vein discovered on my second trip, was visited. This coal was not good. Specimens of the rocks and coal were forwarded to the Smithsonian Institute. The road back was less irksome as the water had fallen so that all streams were fordable. August 3 I reached the "Explorer" and August 7 reached Camp Purcell, Pipe spit.

Prof. Thos. Wilson, Curator, Division of Prehistoric Archæology, U. S. National Museum, Mr. J. R. Bishop and Prof. Geo. F. Kunz, of New York, have taken great interest in this jade deposit. The former has written the subject up in his article on jade.

IX.—Expedition to St. Michael's and return, under Passed Assistant Engineer A. V. Zane, U. S. N.

In obedience to orders, Passed Assistant Engineer Zane left Fort Cosmos on December 26, 1885, en route to St. Michael's, via Nulato. The party consisted of himself, Socoloff (W. R. S.), Riley (interpreter), Suan (native guide from the Yukon) and

Suan's son, a boy of eighteen years. They carried a complete outfit and provisions for fifteen days, on two sleds, one load weighing three hundred and seventy-nine pounds and the other two hundred and forty pounds which were drawn by twelve dogs. A third sled belonging to Suan and his son was drawn by five dogs.

The trip was made as directed. It took twenty-seven days to reach St. Michael's and nineteen days to return. The following is a summary of each day's journey as reported by Mr. Zane. All courses are per compass.

December 26, at 8.55 A. M. left Fort Cosmos and arrived at Kallamute. Traveled the usual route along Putnam river; found snow too deep for easy progress. Distance made, good twenty-eight miles. December 27, left Kallamute. Road easier; less snow. Traveled along the river; noticed many open places in the ice along the left bank. Quartered at Iyak, just below Par village. Distance made, good seventeen miles. December 28, left Iyak, having bought dried fish for dog food, and quartered at Par village, five miles beyond, where we remained next day repairing damages. December 30. Left Par. Shaped a S. E. by S. course following generally the Par river. Road good owing to recent travel by trading natives. Encamped on left bank of the Par. Distance traveled about seventeen miles; made good on course twelve miles. December 31. Broke camp. Stood S. E. along the Par for one mile, then E. S. E. leaving the river and taking a road over the tundra. The Par at this point made a large bend to the westward, and then to the eastward, by south. Found the country level and indented by numerous lakes from one hundred feet to a couple of miles in diameter and considerably below the level of the surrounding land, making the getting on and off the ice heavy work. Reached a deserted house and spent the night. Distance traveled about sixteen miles; good, twelve miles.

January 1, 1886. Shaped the same course, E. S. E. Road as before though over fewer lakes. Crossed the Par river three times; informed by guide it would be met no more as it made off to the eastward. Weather intensely cold; thermometer reading —70° F. at 3 P. M. when camp was made. Distance made good fourteen miles. January 2. Broke camp. Course E. S. E. Road level, through dense spruce forests intersected by many small streams and lakes. Mountain ranges lay on the right hand running northwest and southeast and distant five miles. The road led around their southeast end. Went into camp. Distance made good fifteen miles. January 3. Broke camp and took a S. E. course. Road through dense forests requiring great care in steering sleds. After going eight miles made the Koyukuk or Tug-ga-rag-a-wick river; changed course to S. W. by S. to follow the river, a fine stream about a mile wide with high, thickly wooded banks. Reached a native house and went into quarters. Found the family, a father, mother and two children starving; gave them food. Distance traveled about twenty miles; made good on S. E. course eight miles; on S. W. by S. course, seven miles.

January 4. Under way. Course S. W. Road generally good over tundra; crossed several lakes and tributaries of the Koyukuk. Quartered in a native house. Distance traveled about twenty miles; made good, fifteen miles. Bought fish for dog food. They were from three to eight inches long, fat and oily, and abounded in the small streams of the tundra. The natives roast them on a stick stuck in the ground and inclined towards the fire. As they thawed they apparently regained life and squirmed and moved until roasted to death. They tasted of the tundra. January 5. Under way. Stood S. by W. Road very bad in places and frequent detours were made. Passed a house two hours after starting. Struck the Koyukuk river and journeyed on it. Reached a house and went into quarters. Wind blowing a moderate gale from N. E. Distance traveled twenty-eight miles; made good fifteen miles. January 6. Under way. Course S. S. E. Road as usual through forest and brush and over tundra dotted with lakes. Made the Koyukuk again opposite a small tributary which was followed for seven miles when the house of Suan the guide was reached where the party quartered. Distance traveled twenty-eight miles; made good fifteen miles.

January 7. Remained at Suan's, a well-built hut of logs, containing three rooms, crowded with dirty natives, good natured and obtrusively helpful. Repaired damages and rested dogs. Bought dog food so as to give two fish apiece per diem, one not being sufficient for the heavy work in hand. Paid the following prices: A hand of tobacco for six fish; a block of matches for three fish; a tin of powder for ten fish; one box of caps for seven fish. Tea, needles, thimbles, etc., were also good trade articles. January 8. Left Suan's. Course S. W. by S. Left the Koyukuk, which here made a big bend to the westward, and crossed a hill 500 feet high. Thence the road led over a succession of lakes separated from each other by wooded tracts from one hundred feet to a quarter of a mile in width. Made camp. Distance traveled eighteen miles; made good fourteen miles. January 9. Broke camp and stood S. by W. Snowed all day, making the road very heavy. Found broad iron runners of big sled a great impediment. Encamped, having made fifteen miles. January 10. Broke camp. Course S. by W., over tundra and through forest and brush. Road heavy from recent snow. Reached a native house on the Koyukuk river and quartered. Distance traveled eighteen miles; made good fourteen miles.

January 11. Under way. Course S. S. W. Soon met a small stream; followed it until the Koyukuk was met, down which we traveled until it met the Yukon, a broad, beautiful river with a large bend where the Koyukuk entered it. On the right bank, five miles from the mouth of the Koyukuk, a peak, 1500 feet high, called Be-ne-le-rah-cher (big mountain) rose abruptly from the water; the sides sloped one-third the way down and then fell perpendicularly to the water. Along the right bank of the Yukon was a mountain range, thickly wooded with spruce; along the left bank the wood was poplar and cotton-wood. In the center of the river, here two miles wide, lay a large island; and for fifty miles down these constantly succeeded each other. Reached a good house called the "Big Mountain house," just below the Be-ne-le-rah-cher, kept by a prosperous native. Went into quarters. Distance traveled twenty miles; made good sixteen miles. January 12. Left Big Mountain house. Course S. by W. ½ W. over hard snow. Reached Nulato, one-half mile above the Nulato of the time of the Telegraph Company. Went into quarters in the house of a native trader named Philka, where we were treated royally and furnished all I was short of. Distance made good twenty miles.

The storehouse of the Alaska Commercial Company was closed though Philka had charge of a few trade goods. Nulato, besides the company's store, had four well-built log houses, clean and comfortable. Modern stoves were used and other conveniences. In Philka's there was a mess-table with china, etc., and good food, which I enjoyed, having been short for several days. January 13. At Nulato. Overhauled sleds and gear and rested dogs. Borrowed three big, strong dogs to help on large sled. One native here spoke good English.

January 14. Left Nulato. Course S. by E. on the Yukon. Road heavy from new snow. The new dogs, apparently part Newfoundland, proved much superior to the others. Reached the house of a celebrated old native called Tehunka. In 1851 he traveled eighty miles in one day on snow-shoes from Nulato to St. Michael's, carrying the news of a massacre of the whites at Nulato by the Koukuks. Hired him for fifty pounds of flour to act as guide to St. Michael's. Bought fish and quartered at Tehunka's. Distance traveled twenty miles; made good seventeen miles. January 15. Left Tehunka's. Course S. by W. on the Yukon. Bought for a box of caps a pair of wooden runners three inches wide and lashed them on the iron runners of the big sled. Found them a great help, relieving the dogs of much strain. Road good enough though snow was deep and soft. Quartered at a native's, name Kaltaga. Distance traveled twenty miles; made good seventeen miles. January 16. Left Kaltaga's. Crossed the river and started on course S. S. W. ½ W. through a level valley three miles wide intersected by numerous small streams; over tundra and through spruce forests. Road covered with snow. Found the way by walking ahead and sounding with poles. Had to tramp down the snow to make a path for the sleds. Encamped, having traveled eighteen miles; made good thirteen miles. Before starting across tundra it is necessary to take plenty of dog food. January 17. Broke camp. Course S. S. W. ½ W. Road good one-third the way, over tundra; bad through forest and brush. Encamped, having traveled eighteen miles, all good.

January 18. Broke camp. Course S. S. W. ½ W. over same kind of road. At 10 o'clock reached Beaver house on Beaver lake. At 4 o'clock reached the base of Vesolia Sopka, a mountain 2000 feet high with a triangular top and square base. It marked the intersection of the valley in which the road lay, with another running to southward and eastward. The Unalaklik river rose in the second valley, crossed the first valley at this point, and ran along the northern side, emptying into Norton sound. The road from this intersection lay along the foot of

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NORTHWEST ALASKA
Showing the region drained into
KOTZEBUE SOUND
by the
KUBUCK OR PUTNAM, NOTOARK AND SELAWIK RIVERS
and also
PART OF THE YUKON VALLEY
From explorations in 1885 and 1886 by the U.S. Naval Expedition
under the command of
Lieutenant George M. Stoney, U.S. Navy
SOUNDINGS IN FATHOMS
HEIGHTS IN FEET
Statute Miles
Nautical Miles
DE LONG MOUNTAINS
BAIRD MOUNTAINS
SCHWATKA MOUNTAINS
WARING MOUNTAINS
LOCKWOOD MTS.
YUKON HILLS
KOTZEBUE SOUND
KUBUCK OR PUTNAM RIVER
NOTOARK OR INLAND RIVER
SELAWIK RIVER
SELAWIK L.
KOYUKUK RIVER
YUKON RIVER
Mt. Kelly
Mt. Purcell
Chandler L.
Walker L.
Fort Cosmos
Hotham Inlet
C. Krusenstern
C. Blossom
C. Espenberg
Eschscholtz B.
Chamisso I.
Good Hope Bay
C. Deceit
Buckland R.
Norton Bay
NULATO
NOWIKAKAT

map

the mountain over tundra covered with good, hard snow. Reached Ulukuk on the Unalaklik, a clean, well-built village of three houses, and went into quarters. Distance traveled thirty-five miles; good twenty-six miles.

January 19. Left Ulukuk. Course S. S. W. ½ W. Road over tundra until noon. Then made the Unalaklik and traveled on smooth ice. Found iron runners better than wood for ice. Dogs had hard work, slipping continually. Left one dog on the ice completely worn out. Reached the village of Unalaklik at the mouth of the river facing Norton sound. Went into comfortable quarters at the house of Zulaluk of the Alaska Commercial Company. Distance traveled twenty miles; made good thirteen miles. This village, the largest on Norton sound, comprised fifteen dwellings and a dance house or Cazeem. Forty-five miles to S. S. W. the mountain of St. Michael's loomed up. Offered a reward of five skins for the thermometer lost a short time before arrival. Had sealskin soles put on boots, deerskin being unfit for ice or wet snow. Bought provisions. Exchanged Socoloff's sled for a better one shod with whalebone. January 20. Under way. Course, south. Norton sound being open, took a road on the ice skirting the shore. Crossed over Tolstoi point. Made Nu-wayn-yuk, on a river of the same name, called also by its Russian name Galtzora. Went into quarters. Distance traveled twenty-five miles; made good sixteen miles.

27th day, January 21. Course S. W. ½ W. Road good over ice. Passed the village of Keg-ich-tow-ik, and at 1.15 P. M. reached St. Michael's. Distance traveled twenty-five miles; made good seventeen miles. Went into the hospitable quarters of Mr. Lorentz, the Alaska Commercial Company's agent. Next day the guides, with ample provisions of flour, hard bread, sugar and tea, were sent back; Suan to be ready at Nulato for return trip. Purchased for $18.00 a new, well-constructed sled, made of ash, and for $8.00 new, halter girt-line harness for dogs. The large sled and gear were condemned, being beyond repair. Got provisions for return trip, paying only for such articles as flour, tea, tobacco, etc. Beans, rice, butter, canned goods and trade goods, etc., were given, as much had to be declined for want of storage-room. Procured a maximum and minimum thermometer from Mr. Clark, the U. S. Signal Service observer; and borrowed a dog from Mr. Lorentz. The greatest kindness and assistance were universally met with. Remained seventeen days at St. Michael's, having been detained three days by heavy gales.

On February 7, the return trip of nineteen days was begun. At 10.30 left St. Michael's. Found the sound frozen, so headed direct for Nuwaynyuk. Road heavy from fine particles of frozen snow and salt slush, offering a resistance like sand and gravel. Reached Nuwaynyuk and went into quarters. February 8. Under way for Unalaklik where quartered. The road over the ice was better. Shot a dog who had gone lame and became worthless. Found the lost thermometer and paid the reward. Got back Socoloff's sled thoroughly repaired as ordered. February 9 and 10. Left Unalaklik direct for Ulukuk. Road in fine condition. Crossed the portage, sleeping out one night. February 11. Left Ulukuk. Made the Yukon river at evening. Crossed it, and quartered at Kaltaga's. Broke runner of Socoloff's sled, repaired it temporarily.

February 12. Made Nulato by nightfall and quartered. Found Suan, the guide, waiting. Feb. 13 and 14. Remained at Nulato resting. Bought a new sled for $10.00 to replace Socoloff's. Got natives to draw a chart of the Koyukuk river with tributaries, and the Par river, showing the portage from one to the other used in the summer trips to the Putnam.

Old Nulato, where the massacre of 1851 took place, was visited under the guidance of Kargarine. The only building remaining was that of one of the party of the Western Union Telegraph Company occupied in 1867 and 1868. Saw the grave of Lieutenant Barnard. The headboard was upright: on it, surmounted by a cross, was the following:

Lieutenant James J. Barnard,
H. B. M. S. Enterprise,
Who was killed near this place
by the
Koukuk Indians
Feb. 16, 1851. F. A.

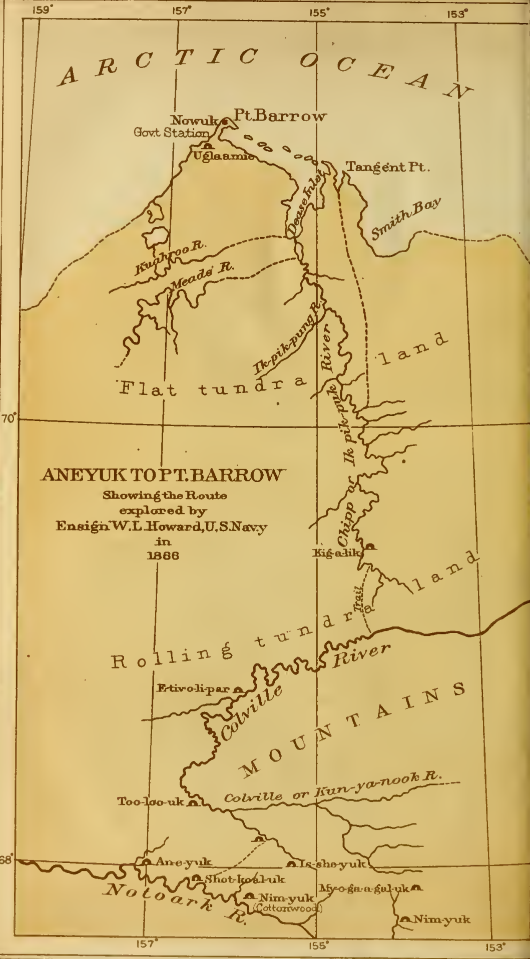
February 15. Left Nulato. Traveled on Yukon. Passed the Big Mountain house and made the Koyukuk river. Quartered in a native house. February 16. Under way; but soon went into quarters, Sucolôff having rheumatism and unable to walk. February 17. Under way. Road over tundra good.

Went into camp at nightfall. February 18. Traveled all day following regular road. Reached Suan's house and quartered. February 19. Remained at Suan's. Repaired damages; hired three dogs and bought dog food. The road over the mountains was decided upon in preference to following the regular route, in spite of guide's objections.

February 20. Left Suan's house. Followed road which was good. Went into quarters in the native house used on the outward journey. February 21. Started on the route across the mountains. Course west. Followed the Koyukuk a little while and then struck across. Road good, over many lakes and small streams. Made a short cut from the road to reach a deserted house, where quartered. Distance traveled twenty miles; made good fifteen miles. February 22. Under way. Course N. by W. over the mountains. Road heavy over tundra and through forest and brush, a way having to be made. Reached the top of foot hills overlooking the valley in which the road lay. Encamped in valley. Distance traveled twenty-five miles; made good eighteen miles. February 23. Broke camp. Course N. W. by W. over tundra, with little snow, and hills 500 feet high with gentle southern slopes and steep northern faces. A stream wandered through the valley and on its banks grew the only wood to be had. Encamped, having made good twenty-five miles. February 24. Broke camp. Course N. W. by W. five miles; then N. by E. ten miles. Reached the head of the valley, forty-five miles long and eight to ten miles broad, running north and south. The mountains on the eastern side rose from 1500 to 2500 feet high; on the western side they were lower. Started over the mountains, course N. W. Road heavy over hills 800 to 1000 feet high. Made camp. Distance traveled thirty-five miles; made good only twelve miles.

19th day, February 25. Broke camp. Course N. W. over the mountains. From the summit overlooking Putnam river, saw Fort Cosmos bearing W. N. W. Killed a worn-out dog. Came on the Putnam river ten miles above the Fort, and reached Fort Cosmos at 7.55 P. M. The route to St. Michael's was that used by the natives in their winter trading expeditions. It led along the Putnam river fifty miles to the Par, up it forty miles to a portage of twenty-five miles, through dense spruce forests, to the Koyukuk river; down this fifty miles; next, forty miles across tundra, a chain of lakes, and through forests to the Yukon river; down the Yukon, seventy miles; then fifty miles of tundra with occasional thick spruce growth, to the Unalaklik river; fifteen miles on it to Norton sound; and finally thirty-five miles on Norton sound and St. Michael's was reached. The road to the Yukon country via the Par, is an old one extensively used in winter by the natives. For the most part it is good, well defined and easy of travel, though it had been but little used the winter before my expedition went over. The route over the mountains traveled the last four days of the return trip, though a trifle shorter to make Fort Cosmos, is seldom used, is not so short to reach Par. Stops were generally made in tenanted huts and dog-food bought of the occupants, who were hospitable and made the party as comfortable as possible. They nearly all spoke a little Russian. Some nights were passed in the open air, seven while going, and less returning. The weather was of all kinds; several heavy snow storms and gales of wind were encountered; the lowest temperature –70° F., the highest 30° F. All hands and the dogs stood the trip well.

The summer route from the Yukon to the Putnam is up the Koyukuk or Tug-ga-rag-a-wick to the Kokachatna; up it a short distance; then a day's portage carrying the canoe; and finally down the Par to the Putnam. The journey to St. Michael's required twenty-seven days including three days of rest. Four hundred and ninety miles were traveled, of which three hundred and eighty were good. The actual time under way was one hundred eighty-two hours and thirty minutes or a little more than seven days. The average daily distance traveled was twenty and four-tenths miles, of which fifteen and eight-tenths were good. Under way each day seven hours thirty-five minutes at a speed per hour of three and one-tenth miles, of which two and four-tenths were good. The return trip took nineteen days including three days of rest. The road was fine, having frequently been used since the trip out. In fourteen days traveled two hundred and twenty-five miles along the old route, then stood across, taking five days to make about one hundred miles good averaging twenty-six and one-fourth miles a day, of which seventeen and a half were good; under way nine hours twenty minutes each day at a speed of three miles, of which two were good.



159°
157°
155°
153°
ARCTIC OCEAN
Nowuk
Pt.Barrow
Govt Station
Uglaamie
Tangent Pt.
Dease Inlet
Smith Bay
Kuahroo R.
Meade R.
Ik-pik-pung R.
River
Flat tundra land
70°
ANEYUK TO PT. BARROW
Showing the Route
explored by
Ensign W. L. Howard, U. S. Navy
in
1866
Ik-pik-puk
Chipp or
Kig-a-lik
Trail
Rolling tundra land
Colville River
E-tivo-li-par
MOUNTAINS
Colville or Kun-ya-nook R.
Too-loo-uk
68°
Ane-yuk
Is-she-yuk
Shot-kosl-uk
Notoark R.
Nim-yuk
(Cottonwood)
My-o-ga-a-gal-uk
Nim-yuk
157°
155°
153°

X.—Expedition to Point Barrow under Ensign Howard.

In accordance with the arrangement made with Owpuk at Issheyuk on my visit to that place in December, I started a party out on April 12 to join the natives at Issheyuk and go with them down the Colville to Point Barrow. Ensign Howard who accompanied me on my trip, was placed in charge of the expedition and I assured him that I would not leave the country until I knew that he was all right; and that I would leave provisions at Fort Cosmos in case he should return after our departure. The trip occupied ninety-six days, from April 12 to June 16, and the account of it is here given in his own words.

April 12, 1886, I left Fort Cosmos with Price (C. M.), Riley, the interpreter, and two natives, en route to Point Barrow. The expedition started with two sleds and outfit weighing 485 pounds and 432 pounds, and 15 dogs. Passed Assistant Engineer Zane with one sled and seven dogs accompanied the party to Notoark. The outfit consisted of the following articles: *Provisions*, 25 lbs. flour; 25 lbs. bread; 25 lbs. corned beef; 4 lbs. tea; 50 lbs. sugar; 15 lbs. lard; 3 lbs. baking powder; 10 lbs. salt; 20 lbs. pork; 1 bottle pepper. *Cooking Gear*, 1 frying pan; 1 camp kettle; 1 small kettle; 1 tea pot; 2 tin cups; 3 tin pans; 2 forks; 2 spoons; 2 small axes; coal oil stove and feeder; 5 gallons coal oil. *Clothing*, 2 suits underclothing; 2 pairs trousers; 4 pairs socks; 6 handkerchiefs; 2 towels; 3 pair boots; 2 blue shirts; 2 hats; 1 sleeping bag and sleeping socks; 1 parky; and 1 pair blankets. *Instruments*, 1 sextant; 1 chronometer watch; 1 artificial horizon; 2 note books; 1 pocket barometer; 1 spirit thermometer; 1 spy glass; 1 compass. *Medical outfit* as made for the Greely Relief Expedition. *Arms and Ammunition*, 1 shot gun with 200 cartridges for same; 1 Hotchkiss rifle, 300 cartridges for same; 2 revolvers, 50 cartridges for same. *Trade Articles* for purpose of paying natives, 50 lbs. leaf tobacco; 8 lbs. lead; 12½ lbs. shot; 17 boxes caps; 8 knives; 10 papers needles; 12 thimbles; 12 combs; 6 bundles matches; 6 packs cards; can of beads; 3 pipes; 10 lbs. powder; 6 snow goggles; 6 files; some match-rope and snappers; and 150 lbs. dried fish for dog food.

The Nutvucktowoark river was reached the first day after a hard journey over almost bare tundra and over lakes and streams the ice of which was covered with water. Made camp where some stuff had been cached on the previous reconnoitering trip.

Found the cache unmolested. Natives had been near but had camped a little to one side to avoid disturbing it. The next day made the Evesheark river and camped near Camp II of the previous trip. Found cache undisturbed. This river is a tributary of the Nutvucktowoark river. April 14, camped at old Camp III on the mountains in a native snow hut made of blocks of snow cut from a packed snow drift and piled around a circular base to a height of a few feet, the roof formed by overlapping the higher layers. Upon becoming warm the moisture congeals upon the snow inside which keeps them dry. These huts are found all through the mountains, being made early in the season and through the winter by hunting parties. At this camp my natives went off deer-hunting. April 15, made Kooloogi̇ck and learned that Owpuk, the native with whom I intended traveling to the coast, was still at Issheyuk. The deer hunters returned, bringing five deer. April 16, left the village and reached Aneyuk on the Notoark river, distant about ten miles N. W. (p. c.). Found the guide of my former trip, Ashewanuk, who said Owpuk was not at Issheyuk and that the village was deserted. Hired this guide to help me find him. Aneyuk is the highest point on the Notoark river reached by the natives in boats. In the fall they come here and wait for the snow to sled into the interior. The skins of the boats are cached until the next season and their frames are placed on high racks to prevent animals eating the lashings. In the spring the people come down by sleds to Aneyuk, put together their boats, and go by water to the coast. This custom is general, only a few families remaining in the mountains. April 17, left Aneyuk and arrived at Shotcoaluk twenty miles distant N. E. (p. c.) where I remained until the 20th on account of a heavy wind storm that filled the air with fine snow obscuring the nearest objects. Here I received one hundred pounds flour that had been sent ahead. April 20, left Shotcoaluk for the mountains. The snow drifted so the leading dogs could not be seen, and everybody suffered from the piercing cold. Connected all the dogs and sleds in line ahead and made for the nearest valley, clinging to the sleds to avoid getting lost. Finally went into camp in a shelter cut out of a large snow drift. April 21, left this camp; made about 12 miles north (p. c.) and reached the Etivluk river whose headwaters are at Issheyuk and which helps form the Colville river. The village, twenty miles west (p. c.) of Issheyuk, contained one family, and I was informed that all the natives had gone down this river and were encamped below. April 22, started down the Etivluk; came to a deserted village and was disappointed in not finding Owpuk. Continued on and reached the village of Tooloouk where I found him. The natives seemed glad to see me and sent dogs to help as soon as we were sighted. There were ten houses in this village and seventy natives; but this number varied, as people were constantly coming and going. After a long talk with the natives, Owpuk consented to take me to "salt water". In the meantime a special hut had been built for myself and party, out of poles stuck in the snow with their upper ends bowed and lashed together and over this frame was put a cover of sewed deer skins. At this place I discharged my new guide and sent back the two natives brought from Fort Cosmos, with a large sled and eight dogs, and a written report of my trip up to date.

We spent a week at this village situated in a deep valley just off the Etivluk river. On the hills above, natives were always on watch for deer, and when sighted, all the young men would leave for them. A number were killed which the women brought in, dressed and prepared. All the work in the village was done by the women; they sledded for and gathered the scarce wood, cooked the food and took it to the men who generally eat together sitting around in a circle. They eat ravenously until everything is gone, there being no apparent limit to their capacity. It is also wonderful the fatigue and exertion they can undergo without food or sleep, recuperating by eating and sleeping alternately for several days. These natives had immense bundles of skins to trade on the coast for seal oil, rifles, etc., the natives on the coast depending on them for their skin clothing. The skins are dried and kept in bundles outside the houses, except wolf skins which are hung from poles at some distance from the village, as a charm against disease. Whenever the sleds stopped the wolf skins were first taken off and hung away as above. A grand dance took place which I attended. This was a rehearsal in preparation for the dance upon meeting the Point Barrow natives. May 1, twelve sleds, including mine, left Tooloouk. Each sled averaged four natives and four dogs. Some were bound down the Colville river and some down the Ikpikpuk. Stopped twice to get deer and learned that the long wait at Tooloouk had been to allow the deer to get ahead as they depend upon them for food. All the deer killed were covered with parasites which the natives eat greedily. May 2, under way; making frequent stops to allow the old people to catch up. All hands traveled on snow-shoes, the sleds being too heavily loaded for any to ride. Sighted a large herd of deer and encamped, having made about twelve miles N. W. (p. c.). Eight more sleds arrived from Tooloouk, having left the day before. The mountains passed this day were lower than those at Issheyuk (showing evidence of their limit) and irregular in shape, and rocky. May 3, in camp waiting for four more sleds from the mountains. These new arrivals were strangers to me. I was advised by a native to distrust Owpuk; this was the only instance I ever met of one native speaking ill of another. May 4, under way, and made about fifteen miles N. by W. (p. c.) avoiding long bends in the river by crossing the tundra where the women gathered berries. These ripened in the fall just as the snow comes; they then freeze on the bushes and are thus preserved until the snow melts down in the spring. We gathered a great many and I found them especially good, their effect being that of a mild laxative. During the forenoon passed a hill about 500 feet elevation with out-croppings of coal. On the sides of this hill beyond the coal were also found large pieces of a substance called wood by the natives; it was hard, brittle, light brown in color, very light in weight and burned readily, giving out quantities of gas. This material was scattered about in all shapes, sizes and quantities. The snow and ice made it impossible to climb and dig; a specimen was preserved. May 5, under way, and made ten miles N. by W. (p. c.) when went into camp on account of strong gale from the westward which blew so hard the dogs could not pull against it. The driving snow covered my glasses, making it impossible to see, so took them off and in the evening suffered from an attack of snow blindness that lasted all night. The natives suffer a great deal from this source. Their only cure is the shaman who beats a tomtom and paints a circle around the eyes with a black paint made of ashes and seal oil, giving the appearance of having on glasses; as the eyes water a great deal, this pigment soon gets all over the face. This camp was at the limit of the mountains; on all sides and ahead was undulating land. May 6, under way, making frequent stops; made about six miles N. by W. (p. c.). During the day an addition was made to the party in the form of a baby boy. A place was hollowed out of a snow drift and a couple of deer skins put in. The caravan then continued on leaving the woman behind alone. Towards evening the mother with her infant came into the camp, having walked a distance of three miles.

May 7, under way. Made about twelve miles N. by W. (p. c.), when reached the village of Etivoli-par. This is situated at the point where the Etivuk river flows into the Kungyanook, or Colville river. At this place those who go down the Colville river leave their boats in the fall and wait for snow to sledge to the mountains. Most of the natives with whom I was traveling remained here waiting for the ice on the Colville to break up. The woman with the baby had hard work to keep up; upon my offering her a ride the others interfered, saying she must go on foot; she also had to make her own fire, cook her own food and use her own special utensils; according to their superstitions to do otherwise would result in misfortune to the child. May 8 to 12, remained at the village, during which time it was either snowing or raining. The natives opened their caches made last fall, and deer meat and fish were taken out frozen solid and in perfect condition. On May 11, the first goose of the season flew over, the natives were very jubilant and by imitating the goose's call kept it circling overhead several minutes. I was not allowed to shoot it. Natives here brought me a small mammoth tusk, but I left it on account of my load and their telling me there were plenty on the Ikpikpuk.

May 12, eight sleds, including my own, started for the Chipp or Ikpikpuk river, going on down the Colville. One native took his boat on his sled and started with us, evidently going down the Ikpikpuk on my account. Those left behind appeared very sorry to part with us and tried again to persuade me to go down the Colville. Made about twelve miles N. by E. (p. c.). Found the Colville to be a very winding river with steep banks on this day's run, varying in width from 400 to 1000 yards. It appeared to be shallow and was filled with islands with a very heavy growth of brush. At camp that night the natives dug roots called mashoo, they were very succulent and tender, and later on formed my principal food. May 13, remained in camp. Sent ahead part of outfit and cached it, following the example of the natives. May 14, under way. Picked up cached stuff and continued on;

made twelve miles N. by E. (p. c.). Sighted a herd of dee near camp and shot five. Country undulating; river, wide an tortuous, sometimes turning at right angles, filled with brush covered islands; banks steep, in places 300 feet high. May 15 in camp. Women sledged for deer killed the day before. Sen part of load ahead and cached it as before. Got six deer during the day.

May 16, under way; made twelve miles N.E. (p.c.) and reached the last camping-place on the Colville river. The character o the country and river as on previous day. From this point according to the natives, the river trends N. E. (p. c.). May 17 to 20. In camp, detained by the snow-blindness of the natives I gave them an ointment of vaseline and laudanum which I had found beneficial. The shaman did his duty by shouting and beating the tomtom. Sent load ahead as before. May 20, under way. Made six miles N. N. W. (p. c.) to the top of the hills, then changed course W. N. W. (p. c.) for six miles and camped on a small creek emptying into the Ikpikpuk. May 21, in camp. Sent part of load ahead as before. May 22, under way. Made ten miles N. W. (p. c.) and went into camp on the Ikpikpuk river. According to custom, sent native ahead to announce our arrival to the rendezvous below, where the natives from the mountains were assembled to start down the Ikpikpuk river. During the evening some of them came up to meet us and showed great curiosity at my presence, but all were kind. May 23, under way. Made the rendezvous village of Kigalik, consisting of thirty tents and one hundred and fifty natives. Just before arriving at Kigalik, came upon the racks holding the boat frames, and each native examined his to see that it was all right. Counted eighteen oomiak and twenty kyak frames. Under the frames was a cache containing the boat covers. As we neared the village our party was met and assisted with extra dogs and escorted to the lower end of the camp which had been reserved for us. In the center of the village a large dance house had been made by sticking poles into the ground and hanging skins over them, everyone furnishing a few skins. In this house the men worked at new boat frames during the day and all hands danced at night, their food being carried there by the women. The latter spent their time in tanning skins and making clothing. The wood for the boats came from the rivers to the southward, passing through many native hands. The boats are lashed with strips of whalebone; the oomiaks are covered with sealskin and the kyaks with deerskins.

May 24 to 30. In camp at Kigalik. Natives building boats, similar to those on the Putnam, and making preparations for descending the river. Children gathered berries and wood, and shot ptarmigan with bows and arrows. Some of the men gathered poles for tents, to be used in trade at Point Barrow where only drift-wood can be got. At this place the last green brush was seen ten to twelve feet high. After this fires were made from grass and creepers with a little coal-oil. A lookout was always kept for deer and all work suspended to pursue them. Flies made their appearance, and geese, ducks and ptarmigan were becoming plentiful, the latter commenced changing their plumage. Two mammoth tusks were brought me weighing about one hundred and fifty pounds each, one foot in circumference and ten feet in length. I was told of another too large to be lifted. There are many superstitions regarding their removal. I was never allowed to have mine in camp, nor even to touch it, until I arrived at Point Barrow. These tusks are found in the spring while going down the river; the water rising washes away the icy earth of the banks and shows the tusks firmly embedded. The natives cut them up into two-pound pieces and trade them on the coast. No inducement will make them take a whole tusk. They make handles, dippers, fish-hooks, etc. out of this ivory. The fish-hooks are made from a small piece six inches long, with a sharp pointed piece, an inch in length, lashed to one end at an angle of 45°. These hooks are baited with deer meat and set all along the banks where they are visited twice a day. Made a sledging trip to the headwaters of the Ikpikpuk river. It is formed by the junction of several smaller streams which drain the hills between it and the Colville. From the top of the highest hill on the river (500 feet), I got a good view of the Ikpikpuk.* It is tortuous in the extreme, bending and doubling upon itself in a remarkable manner. During my absence the natives had made all preparations for starting down the river, boats were covered, sleds put away, etc. I gave my sleds and dogs to Owpuk.

* I renamed this river the "Chipp," after Lieut. Chipp, who was lost on the Jeannette expedition.

June 2 to 8. In camp at village. The ice began breaking and the river rising. The high water forced everybody to leave their quarters on the spit and move into the interior. Many natives moved only a foot or two at a time. The shamans gathered at the bank and would stick their knives at the water's edge to prevent any rising beyond it. Each failure was greeted with derisive laughter as the discomfited medicine men stepped back and picked up their submerged knives. Instead of dancing in the evenings the favorite amusement now was tossing in the sealskin blanket. The river rose six feet by June 6, and then commenced falling. Boats were got ready and all stuff not needed on the journey was cached. June 8, left Kigalik, five oomiaks starting, and made about fifty miles down the river. Just before camping passed a small creek coming in on the left which was stated to be very long. The boats are loaded and handled very skilfully; poles are stuck along the sides to keep the load in place, which is piled four feet above the gunwale. Some heavily loaded oomiahs have kyaks lashed each side to insure stability. The owner steers from the stern, the family sit in the bow and paddle with short handled broad bladed paddles. Each boat has a long handled narrow bladed oar which the women pull, using a hide oarlock. Stopped often to get mashoo root for food, and killed three deer at the last stop. Upon reaching camp the boats were discharged and turned up to dry. This rule was always followed, and occasionally they were well rubbed with oil. June 9, in camp. The country was rolling land with small berry-bearing bushes here and there. The kyaks with the young men hunters went on ahead to secure food. June 10. Under way, and made about twenty miles. Passed a small creek coming in on right side, and camped on left bank of the river, just opposite the mouth of a large tributary. This day the Ikpikpuk averaged four hundred yards in width and fourteen feet in depth. The country was more open, and hills lower. Food was becoming scarce as the herds of deer scattered over the open country and the game kept to the lakes instead of the river. June 10 to 14. In camp, detained by a heavy gale from the southward and westward. It blew steadily for three days, then became squally, hauled to the northward, and died out. Caught our first fish; native name Tee-tal-uk, scientific name, Lota marculosa. I learned that in going down only a few boats went together as enough food could not be provided for all hands at the same time. Their principal food now was the seal meat and oil which had been brought up the previous fall and cached. The young men were out after deer all the time. The dogs were fed on bones and pieces of deer skin with the hair soaked in seal oil. Sighted a few deer, all hands started after them, some going barefooted over the snow and ice tundra, but none were killed. June 14, under way; and made about twelve miles; stopped on account of heavy snow storm. Passed a small tributary coming in on the right side. The surrounding country was now changed to a level waste of tundra with an occasional mound-shaped sand-hill from 50 to 100 feet high. The river banks were low and of sand, on top of this was a network of roots. Low brush grew in scattered places. From this point no rocks were met with, hence all the boats carried stones to crack bones upon.

June 15 to 19. In camp; detained by bad weather. The snow was all gone so the deer had to be brought in on dogs saddled with sealskin bags or blankets placed over the back and tied around the neck and under the belly. These contained pockets on both sides in which the dressed deer meat was put. Two dogs can carry a deer. I noticed a great number of sick people, especially women and children who appeared to have severe colds. I gave them medicine and as they all recovered I was always consulted. June 19, left camp and continued down the river making about thirty miles. Passed a small tributary coming in on the right side. River wide and shallow with less current. Country flat, low and sandy, with occasional small sand mounds and a growth of stubble. Caught two white fish, native name, See, scientific name, Stenodus Mackenzie. June 20, under way and made about twelve miles. June 21 to 23, in camp, detained by sick people. The natives could not shoot game on this account and I was asked to do it. Only wooden bowls could be used in dipping water from the river as to use metal pots would cause the fish to leave. The fish caught here were dried and kept for future use as they became less plentiful lower down. June 23, under way with one other boat, the remainder being detained by sickness. Made about thirty-five miles. At this point the river divides into two branches. We took the left; was told by my guide both went to salt water, the right branch farther to the eastward. The left branch was about one hundred yards wide at starting, soon increased to about five hundred yards, very shoal in places and filled with sand-spits and sand-islands. Banks so low that during freshets the river flows over the tundra. Game getting still scarcer, remaining further in the interior.

June 24, under way and made about thirty-five miles. Banks of river so low as to be scarcely perceptible. Passed through two lakes made by the river widening over the tundra; the first nearly circular and about a mile in diameter; the second, half a mile further on, was about five miles in diameter. Both were very shallow (the boats grounded in the larger) and were full of sand-spits and islands. The surrounding country was level and a network of ponds and lakes of all sizes, with the river winding in and out among them connecting a great many. While crossing the second lake we sighted two tents of Point Barrow natives which caused the wildest excitement, the natives paddling their hardest, and shouting with all their might, although the tents were several miles away. I came to the conclusion from later observations that these people are afraid of the Point Barrow natives, though they have never harmed each other. The paddling and shouting were kept up until we reached the tents. These Point Barrow natives were filthy in appearance and condition, their clothing being covered with grease and oil. As soon as we landed they brought us whale and walrus blubber to eat which even the dogs refused, though the natives ate it with apparent relish. Their language I could not understand at first, the words seemed the same but the pronunciation different, being short and jerky, like that of the Yukon people. These natives had left Point Barrow a week before and were at this place to hunt deer and fish. We camped near these tents and the natives began visiting us. These people were on their way to the Colville and Mackenzie rivers, and crossed the tundra to meet us. They were making their way along the Arctic coast with dogs, sleds and boats, carrying the boats on sleds over the ice until they meet water. The trip from Point Barrow to Mackenzie river and return occupies two years. They communicate and trade with the Hudson Bay natives, the latter sometimes visit Point Barrow, and some of them visited us at this camp. They differed in appearance from the Alaska natives; the tattooing, only seen on the women, being several parallel stripes across the cheeks. The women wore their hair in a knot on top of the head standing about six inches high similar to that of the Eskimos of Greenland. They spent the day dancing and feasting. On hearing that I was out of flour they gave me a fifty-pound sack, which they packed several miles across the tundra.

June 25 to July 12. Remained at this camp waiting for the ice to break off from the coast. I offered every inducement to natives to take me to Point Barrow, but without success. One day a party arrived from the Point to trade. In the evening they got drunk on liquor they brought with them, and insisted upon coming into my tent, making all sorts of threats one moment and the next attempting to embrace us. The sober men of the party had taken their knives from them, and I was cautioned to keep my fire-arms out of sight. They stole everything they could put their hands on, the women returning them as fast as taken. The orgie lasted all night, and the next day they boasted of having been drunk and wanted more liquor. Considerable trading was done here, the interior natives exchanging all kinds of skins for rifles, cartridges, caps, lead and tobacco, which the coast natives had in abundance. Price and I had both suffered a great deal from constipation, and one evening a shaman gaudily attired, visited our tent in one of his trances. He appeared very weak though in reality the strongest man in the party, and remained about fifteen minutes rubbing his hands, shaking himself and whooping all the time. He then left, having cured us as he thought. July 12. Ten oomiaks started for Point Barrow. We followed, the edge of the ice being out of sight of land about an hour. Camped on beach. July 13, in camp, detained by ice. July 14. Underway, pushing through the ice. Dense fog set in part of the time and we were out of sight of land. The navigating of these people was wonderful. We made our way through leads, heading in every direction, and towards evening made the beach along which we tracked until 4 A. M. the next day, only six boats reaching this camp, the others being delayed by the ice and difficult navigation.

July 15, tracked along the coast, and at 9.30 P. M. made Point Barrow six miles above the old headquarters of the U. S. Signal Station, under Lieutenant Ray, U. S. Army. I made my way overland, and at 2 A. M., July 16, reached the house, ninety-six days from Fort Cosmos. Here I found Captain E. P. Herendeen in charge, and three traders, all stationed here by the Pacific

Steam Whaling Company for whaling and trading. I was very hospitably received and entertained. Everything they had was offered me, and pay offered, was laughed at. The ice was jammed on the northern coast and I was told it would be impossible to make my way along the coast to the southward as the ice floe extended as far seaward as the eye could reach. The northern shore of Alaska is very shallow and sandy. All along the coast great spits of sand are shoved up by the ice. The beach is filled with drift-wood. I noticed many timbers of wrecked ships though nothing that could be identified. Two small streams enter the Arctic between the mouth of the Ikpikpuk and Point Barrow.

August 11, I started with the Point Barrow party down the coast in skin boats to meet the whaling fleet to the southward if possible. Forty miles below the point we met the fleet making its way north through the leads, and boarded the "Narwhal," Captain Maillard. Learning that the U. S. Revenue Steamer Bear was just behind the fleet, I returned in the "Narwhal" to Point Barrow and awaited the arrival of the "Bear," which reached there the 12th.

August 13, embarked on the "Bear," Captain M. A. Healy, U. S. R. M., commanding, for transportation to Hotham inlet. August 25, reached Hotham inlet and reported my return to the commanding officer.

XI.—Animals, Birds, Etc.

The mosquitoes are the first things noticed on arrival in the country. Nowhere have I ever seen so many as on the Putnam river during the summer months. It surpasses imagination. We suffered more from this pest than from anything else. At times they would drive us to distraction. The dogs would rub off all the hair around their eyes in efforts to drive the vicious things away. The poor animals would dig holes and crawl in them, hauling the dirt down over them, in their efforts to get rest. Smoke was the only thing of any avail against them, so the first thing on stopping was to build a fire, when the dogs would actually shove their heads right into it to keep the pests off. It is during a calm that the mosquitoes are so bad. The least wind drives them away. The natives relate instances when the mosquitoes have caused the death of reindeer. These animals generally keep off the low tundra land, when these pests are worst. But the deer occasionally during a light breeze venture into these bad places. The wind dying out the mosquitoes rise like a cloud and attack them, especially around the eyes. They run frantically for high land; but the mosquitoes get in their eyes and actually obscure their sight. In a short while the eye swells and the animal loses his way and wanders around. Eventually they succumb and die.

I provided my party with an arrangement that gave them full protection. It was a hood of light drilling which came down over the head and shoulders, with holes for the arms, by which it was readily held on. A steel band ran around the face of the hood and on this fitted a movable mask of fine meshed copper wire. In the lower part of this mask a hole was made with a hinged cover of the same material, so that a man could smoke or eat without removing his mask. When there is the least wind the mosquitoes do not bother one and the mask can be removed and hung to one side as with a soldier's cap. The mask was made of wire gauze because the mosquito netting tears so easily. Having to use instruments in observations for latitude and longitude, I made an additional hole in my mask opposite the eye used.

Bears were very numerous and the natives were abundantly supplied with their skins. We saw four kinds, black, brown, cinnamon and a small bear of gray color. They never gave us any trouble, though we saw natives who had been in encounters with them.

Black wolves are also quite plentiful, and I saw a number of blue wolf skins. We saw four kinds of foxes, red, silver-grey, white, and a cross-fox. Other animals were numerous, such as the wolverine, land otter, marten, mink, beaver, muskrat, and ermine, wood rats, squirrels and white rabbits. Porcupines were everywhere and in great numbers. The only animals of the deer family in the country are the caribou, which are killed by the natives in great numbers.

Waterfowl of all kinds are plentiful during the summer, but migrate south on the approach of winter, except one small variety, something like a sand piper, which remains during the whole year, as do the blue-jays, crow, ptarmigan, white owl and grouse.

Fish.

There are many varieties of fish in the rivers and lakes. Most of which are mentioned elsewhere—but the salmon is the principal one. There are three varieties of this fish in the Putnam and its branches on the north side of the river, but strange to say, not one is to be found in the streams coming in from the south. The reason of this I do not know.

Specimens of every variety of animal, bird, fish, and insect life, besides woods, mosses, and minerals, were collected during our stay in the country which were forwarded on my return to the Smithsonian Institute.

Geology, Etc.

The geological formations of the Putnam river valley show much disturbance and change, as may be gathered from the description given in other parts of the book. Granite rocks are the most abundant, though there is much limestone, slate and conglomerate in the upper part of the valley.

Gold Prospects.

Looking for gold was not one of the objects of my expeditions to the Putnam river country and no effort was made to find it. On our several exploring trips, the ground was always covered with snow, and the weather intensely cold, and in the summer we were engaged in other work, surveying, etc., and had no time to give to prospecting.

On my second trip, however, I was joined on the river by an old miner named Miller, who had come in with a party from the revenue cutter. They turned back after going a short distance up and Miller asked to join my party. I took him along to chop wood for the steam launch. Whenever we stopped Miller would go with a shovel and wash the sand on the bars of the creeks emptying into the Putnam, looking for gold. He invariably found traces of the precious metal, more in some places than in others, and would show me the "color," as he called it, which consisted of specks of fine gold.

Miller said at the time that the prospects here showed better than on the Yukon where he had been prospecting for a year. He was very enthusiastic about it and begged me to "stake" him with grub so that he could remain in the country and continue prospecting; but I could not comply with his request, as I had none but Government stores with me, and these I could not dispose of in such a way.

Coal.

On my second trip to the Putnam I discovered a vein of bituminous coal outcropping on the north side of the river about ninety miles from the mouth. I tried a lot of it in the furnace of the steam launch with very satisfactory results, though it had been long exposed to the weather. The vein was between two and three feet thick and dipped at an angle of 30° from the river. I think that a good quality of coal will be found further in the bank.*

Trees.

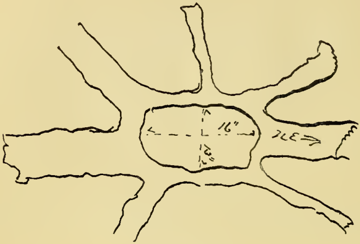
Fair specimens of the various kinds of trees were cut down, measured and inquiries made of the natives concerning them; the following notes thereon are submitted.

Spruce.

A spruce tree cut near Fort Cosmos was a good example of its kind. Height, 50 feet; N. E. diameter of trunk, the longest, 16 inches; N. W. diameter, the shortest, 13 inches. Branches began three feet from the ground, increasing in size and length to the middle of the tree, then diminishing to the top. The branches next the ground were dead, as is always the case. Branches from three to five feet long never have a greater diameter than 2½ inches. This tree inclined to the southwest (as most of them do). The roots to the northeast were longest and largest, one being nine feet long and eight inches in diameter. The depth of soil in which this tree grew was but seven inches, the smallest threads of roots went no further down. The main root extended five inches below ground. All the roots ran laterally in soil of black and gray dirt with light sand and dirt below. All the spruce trees were about like the one described. In the Putnam valley the roots are longest and stoutest to the north-

* For an account of the curious mineral substance found by Ensign Howard, see account of his trip to Point Barrow.

east; in other valleys this applies in the direction of the prevailing winds. All side roots are small and unimportant. The little soil over the roots is barely sufficient to hold the trees against the prevailing winds of summer. The snow and freezing of winter enable them to stand the gales of that season.



TREE ROOT.

The native name for spruce is Nu-puck-tuck. The trees lose their leaves in spring; they get frozen to the tree in winter and so cannot fall. When young and tender the leaves are sometimes eaten as food.

The Cotton-wood.

The cotton-wood grows all over the country and is found in places where no other trees grow. The wood splits easily and on this account is often used in building, and in making fish-traps. When spruce or birch is scarce it is used for canoes. It is also used to weaken too strong tobacco, and to make it last longer. The cotton-wood dies first at the top, caused by the winds cracking the upper bark which lets in the cold. The native name of the tree is Nimyuk, hence so many villages of that name.

Birch.

The birch are clean, well-shaped trees, varying in height from twenty-five to forty feet. A specimen tree cut was 31 feet high;

circumference at butt, 18 inches; five feet up, 16 inches; at ten feet from butt, 13 inches. Branches began fourteen feet up, none lower, and not very many above. The largest trees all seemed dead and on them a parasite was found. Before dying, when the branches show signs of decay, a soft white fungus appears; after death this changes its color to slate or gray and becomes hard. The birch grows all through the country and is not confined to the water courses like most of the other trees.

This tree shows the advancement of the seasons; its buds are the first to appear in the spring and its leaves are the first to change color in the fall. The tender wood of the branches is eaten with the juice of the tree. The native name is Ool-la-le-yuk. Its wood is the hardest of all trees and is used to make sleds, bows, etc. The bark is gotten in spring and from it are made canoes, house coverings, pans, etc. The buds are eaten by ptarmigan. The fungus called ap-pa-chuck women mix with their chewing tobacco.

The Willow.

There are several varieties of this tree. The specimen cut at Fort Cosmos will serve in dimensions for all. Its length was 17 feet; circumference at base, 6¾ inches; five feet up, 5¼ inches; ten feet up, 4 inches. About five feet up the branches begin increasing and so to the top where they are thickest. The largest trees are 10 inches in circumference at base, but these usually had dead tops and from the lower parts numerous sprouts grew. The willow growth is mostly thick like that of the Mexican mango; it is more of a shrub than a tree; it is found on all the lakes, and along the banks of the streams its growth is rank.

The native name of the above specimen is Con-nugn-yuk, and it is found in all parts of the country. It is sometimes used for bows when birch is scarce, and snow-shoes are made from it. The ptarmigan eat the buds, and the moose and bears, the twigs.

Another kind of willow is the Oak-pik, similar to the above in most respects. The bark is used to make nets. The animals eat the buds and twigs as above. A third kind is Ar-koo-too-ark. It has a fibrous blossom from which match-rope is made. The buds of the young plant are eaten in summer. Animals eat them as in the other kinds. This willow grows around lakes and rivers and in the water. A fourth species is Nu-wung-yuk. Its bark is used as a red dye, made by scraping it fine and letting it stand in water until it turns red, when it is mixed with the water. From the wood, pipes, snow goggles, etc., are made. Ptarmigan and rabbits eat the buds, beavers the roots, and moose the twigs. This willow never grows in water; it thrives on high land and on elevated tundra.

Fuel Wood.

Dry spruce wood was used exclusively in the boats for fuel; other dead wood gave poor results. The standing dead spruce was used; the higher the land the better the wood, having fewer knots and a straighter grain; in the low wet places the grain of the wood runs spirally. The green spruce gave no satisfaction in the boats but did well in the heating stoves at Fort Cosmos and was used altogether. In the summer the green spruce is nearly impossible to split, owing to the sap; this in the winter freezes and the wood is split with ease. The opposite is the case with dried spruce.

The largest tree seen in the whole country was a spruce near the headwaters of the Putnam. Dimensions, circumference at base, 80 inches; six feet up, 68 inches; height, 80 feet. Trees of this size, however, were seldom met with.

XII.—Natives.

The people inhabiting northern Alaska are known by the general name of Inuits and belong to the Esquimau family. They seem to be divided into geographical sections each having its own name; thus, those about Point Barrow are known as the Ugliammis, those about the Peol river are the Tatlits, those to the southward on the Yukon are the Kutch-a-kutchus. Those with whom I was most thrown along the Putnam, Selawik, Notoark and Colville valleys are known as Malemutes. It would be difficult for me to say much concerning their origin. Long ago they were undoubtedly closely allied to the natives of the Koyukuk river; because the oldest natives of the Putnam valley still speak that language and say that their fathers knew no other. But further than this I could learn nothing.

The Malemutes all speak the same language and have the same customs and social laws. Those living in the Putnam or Kubuck valley are called Ku-wung-mutes; in the Selawik valley, Se-lewing-mutes; in the Notoark, Notoarkmutes; and in the Colville or Kunyanook they are Kunyamutes. Their complexion is light brown, the color of a new saddle. The skin of the face is darker as it is much exposed and seldom washed. There are shades of color but such diversities are merely accidental. The features are quite regular; the countenance round, and the expression open and good-natured. The eyes are small and black and nearly even with the face; the eyebrows short and straight. The nose is small and flat; the mouth, large with moderate lips and good teeth which in the old get worn to the gum from hard use. The hair is black, long, coarse and straight. Aged persons become gray but seldom bald. In stature, weight and size they compare favorably with the whites. The shape and size of their heads are normal and well proportioned; the forehead is high, like Europeans, the cheek bones are slightly prominent, but less so than in the North American Indians.

The faculties of seeing and hearing are highly developed, but the senses of smell and taste seem to be deficient. In actual masculine strength they are inferior to the whites, nevertheless their power of endurance is remarkable; they travel unceasingly and untiringly, regardless of the severity of the weather, and oftentimes with insufficient food and little sleep. Concerning their longevity it is difficult to say; there are many old people especially men, numbers of whom are grand-parents but they are very decrepit. The age of puberty is the same as in whites. There is nothing peculiar or strange connected with the functions of generation; they are subject to the same laws as the other races of human beings.

The women braid their hair in two long plaits hanging down the back; occasionally a man does the same. The men, however, as a rule wear the hair long and flowing excepting a bang across the forehead. They are generally beardless. It is said that they pluck out the hair, only permitting it to grow when they become old men. Tattooing is restricted to the women. It consists of a few lines on the lower lip and chin, and is seldom done until after marriage. The cartilage of the nose in both men and women is often pierced, though no rings or other nasal ornaments were seen. Ear-rings are worn by all the women and some of the men; bead ornaments on the hair and bracelets, only by the women.

Wearing labrets in the under lip just below the corners of the mouth, is confined to the men. The custom seems to be dying out, for though all the old men had pierced lips many of the young did not; also many who had holes for them wore only a single labret, and others, none at all. The first eventful ceremony in the life of a youth is the operation of cutting the lower lip for the labrets; after it he assumes the prerogatives of a man. The holes are cut by some old man, generally a medicine man, with a knife. The boy stands the operation uncomplainingly, pushing his tongue against the inside of the lip so as to assist the doctor. Before the cutting, the boy has to make presents to all the old people in the village, and in return he receives their blessings. If he be the son of a wealthy man he gives skins, knives, etc., but if poor he gathers and distributes large quantities of berries and roots.

Marriage.—The marriage ceremony is an unimportant one and seldom attended by any demonstrations. A man desiring a woman for his wife obtains the permission of her parents, and then asks the woman. Should either object there is no marriage. If accepted he makes presents of clothing generally to the parents, sometimes to the bride. If the groom be rich his marriage is sometimes followed by a supper and a dance. The public announcement of marriage is by word of mouth. The wedding is of the simplest, the groom goes to the hut of the bride and establishes himself there or else he takes her to his to-pee.

Polygamy though lawful and practised is not general, the limit to the number of wives being the ability to support them. The wives live in the same hut if they can do so amicably, but when this is impossible the favorite wife is retained and the others cast out to shift for themselves. Widowers re-marry. In case of disagreement between stepmother and stepchildren the stepmother leaves, and another and more acceptable wife is taken. Widows also re-marry, but their children are distributed among the deceased husband's relatives, so that on their second marriage they are unencumbered. Relatives marry, but incest is not approved and seldom committed.

Death.—Death is regarded as a necessity and the natural end of man. Their grief is violent for a couple of days, occupied by loud crying and moaning, and then it passes. The ceremony of burial is simple; the most common way, that practised by the

Notoark natives and to a limited extent by all the others, is to place the corpse on the tundra and leave it to rot or become the food of beast or bird. The Putnam and Selawik tribes sometimes put the body in a rough box of hewn logs placed on the tundra. Frequently the dead are placed on the ground and a tent of poles made over them; and again they are laid between and across uprights.

The graves of the rich are distinguished by stones or poles piled about them. The dead are never placed underground. Sleds, arrows, utensils, tools, etc., are left with them, but no food. It is believed the dead go south, returning often as ghosts, and sometimes they can be seen playing games in the aurora. Graves are always visited soon after the interment to ascertain whether the dead have returned to life; but these visits are not often repeated, and the departed are soon forgotten except in story and legend.

The men live the longest. Judging from the great number of graves seen, and the reports of the natives, the race is diminishing, and the death rate largely exceeds the birth rate. The summer is the season of illness, and in the fall they die. Pulmonary diseases are the most prevalent, the damp and exposure of summer give bad colds which, for lack of treatment, develop into something more serious. A few get frozen to death.

Characteristics.—It can be stated that these people of northern Alaska are of exceptional good temper and kind disposition. They are tender and considerate to the aged, and possess a wonderful love for their own blood. The friendship between Ounalena and Callupuck was closer and more devoted than is often met with in more civilized places. Ounalena had been my guide on my previous trips and had died during my absence; his brother Callupuck was my guide on my last trip. Callupuck cried when he first met me, telling the story of Ounalena's freezing to death in the cold of last winter. Great tears rolled down his unwashed cheeks as he spoke of his brother's bravery, his power, his hunting, and his love; and when I showed him the old chart his brother had made for me, he broke out in sobs, "Oh yes, I loved Ounalena better than my wife; I could get another wife, but never, never, another brother."

Relationship is binding; the most distant cousinship is recognized. The family never forgets its own no matter how far they may be separated. Parents are noticeably kind to their children. They work for them, help them, and do everything to please them. The male children are preferred; a father will exhibit his boy with the greatest pride but the daughter will be kept in the background and merely mentioned, yet each is treated with equal consideration in their bringing up. The young babies are in the care of their mothers, who carry them inside their parkies, usually on the back so as not to be in the way when working. The older children are carried astride the necks of the women with their feet held in front to prevent falling. The excessive pigeon-toe formation of the women's feet is probably the result of this mode of carrying, for the girls are kept on their mothers' necks longer than the boys.

A sort of communism exists among the natives in a village; all articles are used in common, and borrowing and lending are obligatory and customary. The aged and infirm are taken care of by the people of the villages in which they live; so are the sick and helpless. Blind people are looked out for by their friends. Insane people, of whom there are a few are in charge of medicine men, who bleed them to effect a cure. Violent lunatics are killed. They have no chiefs, but a decided respect is paid the richest man, and his voice is the deciding one. They are very imitative and practical and follow the whites as much as possible, adopting such habits and customs as will be beneficial to them.

The women have entire control of the food, regulating when it shall be eaten, the kind, and the amount. They are always consulted in all matters relating to trade, traveling and domestic affairs. Though apparently treated with indifference their influence is distinctly felt. Instances are numerous where a man's stout denial has been changed to ready assent after an interview with his wife.

Crime.—The only disturbing element in the lives of these simple people is WOMAN. For her they quarrel and fight and even commit murder. A murderer is invariably killed by the son of the murdered man, if there be one, or by the brother or father. It may be that the proper avenger is too young to appreciate his responsibility as avenger, if so the matter rests until he reaches a proper age, and he then does his duty to his murdered parent by taking the life of the son of the murderer, for the original criminal will doubtless be too near the grave to make the killing him a satisfactory reparation.

Stealing is the greatest moral offense. A thief is looked down upon by everybody, and is treated with the greatest contempt. I knew of a case where a husband left his wife because she stole; he took his son with him, but said he had little love for the boy as he was the child of a thief. During my whole stay amongst these people I never heard of a case of theft.

Suicide is rare. There are instances where incompatibility has made life unbearable and the man hanged himself. So too, great sufferers get their sons or wives to end their miseries by sticking a knife or spear into their hearts.

Social Customs.

Heirships.—A son generally lives with his father until the old man dies, when he marries. Should there be several sons the older ones marry and establish their homes leaving the youngest to take care of the father. In case of death the property goes to the eldest son who divides a small portion of it among his brothers and sisters. The mother gets no property but is domiciled with the heir and exercises great influence in all his bargains. If the eldest brother dies childless, the next brother succeeds to the estate. Daughters are not lawful heirs but their uncles must give them a little something. When there are no sons or brothers the succession goes to a sister of the deceased. A child heir has his property taken charge of by his uncle who also must take care of the widow until the son comes of age and assumes the responsibility.

Surgery.—Surgery is practised in the cutting off of frozen limbs. An assistant holds the patient and the medicine man performs the operation, cutting off the frozen part. The limb must mortify before cutting so that all the tissues will be contracted; no live flesh is ever cut. The instruments used are a knife and a saw and nothing is placed over the cut except a little seal oil. The invalid must stand the pain without flinching or uttering a sound. An ordinary severe cut is sewed with sinew; a serious cut is bandaged tight above the place, and then sewed. The loss of a finger is healed by sewing flaps of skin together over the bone. All these operations are performed by doctors or medicine men.

Medicine.—The only medicine employed is seal oil; its action is laxative. To cure ordinary petty illness such as headache, rheumatism, etc., the patient lies down and a belt from round the waist of a medicine man is put round the head, arm or leg as the case may be. Through the bight of the belt a stick is run as a lever. The shaman then asks questions of the spirits and raises on the lever; if the answer concerning the patient be favorable the member in the belt comes up easily; if not, in spite of all his pretended straining and groaning, the sick member will not move, as he makes it appear. Some natives before traveling go through this nonsense to ascertain whether they will remain healthy during the journey.

Doctors.—The influence of a doctor is all-powerful; he heals the mind as well as the body; he has much to do with the success in hunting and fishing; his tenets are those by which the people live. There is absolutely no knowledge or idea of a god or of a providence; nor is there worship of any kind, of animal, idol or things. A doctor, medicine man, or shaman is born, not made. The superstitions surrounding the "Unatcoke" (doctor) are unique. The child is born with blood over his eyes, and at four years of age blood comes from his eyes and his forehead, which must be wiped off by his mother or brother. No especial attention is given his babyhood. After his fifth birthday the child goes into the mountains, remaining from one to five months. In this retreat he sees the ghosts and holds communion with them. They instruct him, taking care of him, and feed him on back fat of deer, bushes, berries, etc., returning to his home the young doctor, in the presence of friends, vomits all he has eaten during his seclusion. He is now prepared for the many functions of his sacred office, and is qualified to cure his relatives of diseases. His position in the community is advanced; he takes what he wants, and can refuse meat if he by his occult powers, sees it is in motion, for to eat would cause his death. His trips to the mountains are made frequently and oftentimes in company with other associates. With increase of years comes increase of knowledge and power; he ties himself apparently hard and fast, and then suddenly gets loose, and performs many other simple feats of legerdemain; he spits fire; he pulls birds from his mouth; and he does tricks of jugglery. It is commonly believed he can cure all ills; that he can drive away by his spells the fish and deer, and perform miracles, even raising the dead to life. Whiskey he makes from water, and back fat from snow.

A doctor occasionally fasts for four days, and in order to renew or refresh his powers, holds communication with ghosts introduced by some other all-powerful shaman. By consulting the white man's ghosts he procures tobacco and gets beads. In the ordinary affairs of everyday life he does his share, nor is any great deference paid him, except when in the performance of the duties of his sacred office. He dies and is buried like other men. However, his spirit returns, and visits the earth four times before taking its final departure. There is a story that an Inuit doctor was beheaded and his body was placed in a dance house while his head was thrown into the sea; in the morning the head returned to the body and the man became whole.

Doctors marry, their wives living in the villages; they also have ghost wives in the mountains. Their offspring sometimes become doctors, but not of necessity. Women likewise are doctors possessing all the occult powers of the male members of the order. They marry. Sometimes they become the wives of the ghosts in the mountains as well as of men in the communities.

Perfect faith in these medicine men is not held by all. There are different degrees of confidence; and a few are prophets without honor.

Amusements.—The outdoor sports of the natives are very like those of the whites. The boys play shinney and are sometimes joined by the men. And they jump, wrestle and kick. In all, the old men take the deepest interest, encouraging and directing the youths. Kicking at a suspended object is great sport and amuses them for hours. Observing that some of them could kick higher than their heads, I had the object raised as high as I could reach and offered a prize of a sheath knife to the one who could kick the object. The young men tried repeatedly and failed. Finally an elderly man who had been directing the others was induced to try. Taking off his clothes, he made the attempt and succeeded. My men could not kick as high as the natives, but could beat them at jumping.

Tossing in a blanket of sealskin is a favorite pastime. The person tossed—man, woman, or child—goes through the motion of walking while in the air, and must alight on his feet in the same way. When he falls he is laughed at and some one else takes his place. Those holding the blanket sing and shout; as many as fifty people, men and women, sometimes enjoy this sport.

Dancing is the greatest pleasure of men, women and children. It is of different kinds, representing animals, birds, hunting and fishing, the habits of the whites, etc., and is always accompanied by all manner of contortions, persisted in until the participants are prostrated by sheer exhaustion. A good dancer is a man entitled to consideration and respect. As much noise and fuss as possible are made at these dances; tomtoms are beaten, and all hands sing and shout a rude monotone with their greatest power.

Card playing takes precedence of all games. These people are natural gamblers, and never let an opportunity pass of gratifying their passion. The game is Russian, played with a pack of ordinary playing cards, bought for a high price from the traders. They call it Car-tuk, playing it continuously sometimes for forty-eight hours. So infatuated are they with it, that even the few moments of rest on sledging trips are passed in gambling. The stakes are sometimes high; a man often loses his entire stock of skins at a sitting. Women play quite as well as men, but their stakes are never high. This habit of gambling with cards is becoming common to all the natives, even to those who have never seen a white man, yet it was introduced into the country but four years back. So prevalent is it that already there are some professional gamblers who live principally by their winnings. One of these came to my camp and lost everything. However, he got me a raft of good logs, and with his payment again tried his fortune; and when he left he had a good stock of skins. The game of poker is understood by a few and in a year or so will probably be very popular.

Music.—The natives are exceptionally fond of vocal music though their songs are decidedly monotonous and, to my ears, destitute of melody. Whenever a native from a different locality comes among them and sings a new song they gather about, listening until they catch the tune, when they take it up and sing it for hours. The tomtom is the only musical instrument.

Traveling.—When the river breaks traveling begins, some go to the mountains, and others to the coast. Those going to the coast carry their families and all their possessions in large skin boats (oomiaks) the owner steering and the others paddling enough to keep in the stream while the current takes the boat down. Two or three small families often go in one large boat, They follow a day or so behind the ice, reaching Hotham inlet be-for it gets clear. Stops are made on the journey to catch fish for immediate use and for use at the trading station. A rich man travels in state; he never takes any other family than his own; he hires paddlers and a steersman; and enjoys all the luxuries he can. In returning up the river, they track along the banks using dogs. A sealskin tow line twenty to thirty fathoms long is made fast to a knee one-quarter the length of the boat from the bow, and four to six dogs are harnessed to the other end. A boy goes ahead as a dog leader and a man follows as driver; the latter's position is not an easy one; sometimes a dog will go to one side of a bush and the next dog the other side, or the head dogs will go over a fallen tree and the others under it, causing trouble and a dog fight and necessitating a delay to straighten out again. About two miles an hour is made in tracking; delay is caused by the dogs having to be shifted often from one bank to the other in order to get good footing. Occasionally in places dogs cannot be used and recourse is had to poles and paddles. Whenever the wind is fair sail is made. Lazy natives often wait two or three days for a wind rather than pole or paddle. Should a boat be under way all night as sometimes happens, the occupants stand regular watch.

On the return trips they fish a great deal, loading the boats down with the catches. Whenever stops are made boats are discharged, hauled up and turned bottom up to dry; tents are pitched, and camp made. In times of great hurry tents are not pitched, shelter being found under the lee of the boats. The families of the hunters remain in tents on the watercourses and catch and dry fish. At the first indication of thawing the winter huts are deserted and deerskin and drilling tents resorted to.

Hunting and Fishing.

Hunting.—Deer hunting is the most indulged in. The most successful hunter is the hero of the season, hence the sport is eagerly pursued and greatly enjoyed. Many superstitions surround the deer; at times the meat must not be cut with an axe, nor can it be cooked in the living house; only certain parts should be eaten, etc. All these observations are particularly necessary in the case of white men; and are rigorously enforced unless they are given a valuable present. There are deer all through the country, especially in the mountains at the headwaters of the Putnam, Notoark, Allashook and Colville rivers, where they gather in large herds, and numbers are caught by the following ingenious plan.

Running for miles in two converging lines they make piles of stones four feet high and having the general resemblance of a man. Beginning at the outer ends of these lines, which are miles apart, the piles are built every thirty yards; the distance gradually lessening as the lines converge, until at their inner ends, where the width is about forty yards, the piles occur every ten feet. Connected with the inner ends of these piles is a circular place marked out by bushes concealing a rope securely fastened at the ends and in other places along it. To this rope are made fast numerous laniards having slip nooses at their ends open and held up properly in the bushes by small stakes. The deer are driven inside the lines without observing the stones; the natives then close in shouting and frightening the deer, who mistaking the stones for men rush on and seeing the opening ahead dash at the brush and are caught in the nooses by the horns or legs when they are killed by spears. As many as twenty-five are caught at a time.

In the narrow mountain passes frequented by deer similar arrangements are made. One native caught ninety deer during the season. In the big lake near the limit of the mountains large herds of deer gather in the fall. It is shut in by the mountains, with the ends open and accessible, but the sides so very steep that only in places can the deer climb; at such points some natives conceal themselves while others drive the deer in the ends. The hidden natives rise and make a great noise and the deer becoming frightened take to the water, where they are speared from light canoes made of deer skins shaped like the kyaks of the coast. Hundreds are killed in this way. When I reached the lake early in March I saw a great many dead deer lying about the banks untouched. These deer are killed in the fall when the herds begin gathering to move further south and at this season they are in best order and the back fat is gotten.

Bears.—Bears are numerous but are very shy and not often encountered, though their tracks are seen in all parts of the country. Some localities are recognized as their homes, notably the small tributaries of the Putnam near the headwaters. The natives say that in winter the bears live on high land in dens carefully constructed of leaves and lined with reindeer moss, each den having three to ten bears. These places are discovered in winter by observing the bear marks, such as broken bushes, nail prints on trees, earth thrown up on adjacent brush, etc. Finding these, the snow is cleared away until the tracks leading to the lair become distinct, which is then surrounded by several natives and the bears killed by spears.

They are also killed by shooting them from blinds made of brush set up on the banks of the rivers at the places where the animals come down in early morning and late evening to get the fish swimming in shallow water. The natives say that the bear has one young one the first winter and thereafterwards two. The period of gestation is from ten to eleven moons and birth is in the spring just before leaving the winter dens. During the long winter they live by sucking their paws. The natives say that they eat clay which they retain until spring.

The preparation of the dead bear for eating is a superstitious proceeding. The skin is removed from the head and the head cut off. A native then takes it and standing astride the body with the head in both hands raises it high in the air and lowers it three times, touching the body each time just over the heart and muttering an incantation. After the third touch he throws the head with all his might so as to hit the same spot over the heart and utters a loud shout in which all the natives join. This ceremony is supposed to drive the bear's spirit to the mountains. After removing the skin the abdomen is opened with more superstitious observations; but never in the presence of a white man; and certain parts of the animal are left on the ground, for to remove them would drive the deer from the mountains. The ears are always cut off the skin.

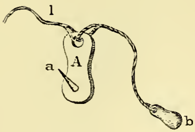
Mountain sheep are killed with rifles. These sheep are not numerous; they live in the mountains and are very wild. Their white skins make good blankets. The other animals are also shot. But they are principally caught in traps, the old-fashioned figure 4 under a heavy log, and the common steel trap being used.

Ducks, geese, ptarmigan and other birds are shot and caught in nets and traps, especially the ptarmigan. In the spring when these birds are mating, they are very combative, and the males fight one another constantly. Several birds are shot, skinned, stuffed and made fast to a net twenty-five feet to forty feet long and three feet deep, made of sinew quite like a seine but with smaller meshes, set up on the rocks and bushes where the ptarmigan feed. The live birds attack the decoys, get enmeshed, and by their struggles attract others who likewise get caught. By this means great numbers are captured. Another way of getting ptarmigans is to set small nooses in the bushes near the ground, the birds get their heads in and draw the cord tight in their efforts to escape.

Waterfowl are caught by anchoring to the bottom of ponds a piece of whalebone to which is attached a number of small nooses. The birds in diving for food get caught by their heads. During the moulting time in spring, birds, particularly geese and ducks, lose most of their wing and tail feathers and being unable to fly are speared.

Caching.—There are three ways of caching; above the ground, on the ground, and under the ground. In the former way a scaffold eight or ten feet high is built, and the meat placed on top covered over with a deer skin. Underneath the scaffold is hung by a piece of sinew, some small bit of clothing that can be moved by the motion of the wind to frighten away wolves and foxes. In caching on the ground, resorted to when wood is not convenient, the deer is placed so as to have the feet sticking up through the snow, and attaching to one end of the legs a small fluttering object which keeps off the enemy. The third way is described elsewhere, in the account of my sledging trip to the Notoark. I often noticed wolf tracks all around the caches but never dangerously close. It is thought that they fancy a trap is set for them, and so keep at a safe distance. A cache is regarded as sacred. Only to save life is one ever opened, and in this case the owners are found and paid for what is taken. All hunting parties cache their meat, leaving it until it is needed. So do traveling parties who go so heavily loaded that they can carry but little food.

Fishing.—All means are used to procure fish. They are caught in seines, by spearing, with hook and line, in traps and in gill nets. Seines are made of the under bark of the willow plant and from grass; stones and pieces of antlers make the sinkers, and pieces of spruce wood, the floats; the whole when completed is about seventy-five feet long and four feet deep and is like the seine of commerce. Women and children always haul the seine, running it from a woman's canoe—a small boat of birch bark—very much as white men do. Often a thousand pounds of salmon are taken in a haul. The salmon start up the river soon after the ice leaves and run until it freezes. As soon as the fish are caught they are split open down the back and the back bone removed; they are next spread out on poles until perfectly dry when they are put under shelter and lightly smoked for several days. The object of smoking is to prevent the fish getting fly-blown. Spearing fish is the amusement of the boys and men. It is done from the banks and in kyaks. In hook and line fishing the lines are made of whalebone strips and the hooks of ivory with sharp metal points. The figure gives the idea; "b" is the sinker of ivory. "A" the ivory part of the hook into which the metal point "a" is fastened; and "l" is the line. No bait is used, the hook arrangement corresponding to the fly. Fish baskets made of willow and like those in ordinary use with us, are common in these waters.



FISH HOOK.

When the river is frozen, fish are caught by digging a trench in the ice and placing a row of stakes in it close together and reaching to the bottom; this picket as it were, is allowed to freeze in the trench. At one end a pen is made connecting with the fence by a funnel-shaped basket, the smaller end opening into the pen. Fish follow the fence and entering the pen through the basket cannot get out. A hole is made in the ice over the pen, and the fish speared and brought out. In the early winter a great many are caught in this way; but none as the season advances. Hooks and lines are used principally through holes in the ice when the river first freezes.

Nearly all the lakes as well as the rivers abound in fish, although in some the water is too deep for much success in fishing. This is especially true of the large lake drained by the Colville. Its fish are Su-luk-pow-wuk, Copetic, Col-lic-pic, and Col-lick-puck the largest of all these fish. Natives have a story that they are sometimes over fifty feet long and swallow a deer, horns and all.

Salmon.—Salmon of several varieties are found in the Putnam river. They are at their best in Hotham inlet before starting up the rivers; then they are fatter, their meat is firmer and of a deep red color, and their shape is regular. Those caught up the river late in the fall would hardly be recognized as the same fish, their backs were bowed and had spots on them that were soft and seemed to be decayed meat. A great many dead ones were seen up the river. According to the natives, those fish that go up, never come back, and after spawning, unless they are caught, all die. The cause of death is said to be starvation, as they never eat in the river. In many that I examined, I noticed that there were no visible traces of food. The young fish are supposed to remain in the river until the ice breaks when they go to sea, returning after an absence of three years.

Food.—The principal food of the Selawik and Putnam natives is fish; it is the most relished and is preferred to any other meat and is eaten either cooked or raw. Besides fish, all animals and birds go to supply food; especially the deer. With the other natives, deer meat formed the principal food. Every part of the deer has its uses. The skin furnishes material for huts, tents, boats, clothing, bedding and rope; the sinew, thread; the antlers, sinkers, tool handles, etc.; the hoofs, as small boxes; the hair, mixed with tobacco, is smoked; the bones, crushed and boiled, yield oil; the marrow gives grease and hair oil; from the contents of the stomach a soup is made and the flesh is eaten raw or roasted or boiled.

As soon as a deer is killed the throat is cut and he is skinned, and the back fat cut off. This is the most highly prized part of the animal and is the favorite dish at a feast. It is eaten raw, boiled and roasted. To me it tasted like rank fat bacon. The cooked meat is either boiled in pots or roasted on wooden spits before the fire. I thought it excellent, also the marrow from the hot bones. The raw meat frozen is eaten on the march; I found it good. Generally when there is a surfeit of deer, the lean meat is given to the dogs, the natives preferring the fatter portions, intestines, and those parts usually thrown away by civilized men. The bones are cracked and the marrow extracted. The joints are saved until a sufficient quantity having been accumulated, they are pulverized by pounding between two rocks and then boiled; the grease is skimmed off and allowed to cool when it looks like lard. It is considered a great delicacy.

In the spring the backs of the deer are covered with parasites that spoil the skin by eating holes in them. They are an inch long, one-fourth of an inch in diameter, tapering at both ends, and cream colored. The natives say that they eventually turn to butterflies. These parasites are eaten raw and considered a delicacy. My disgust when offered them was regarded as ridiculous. Bear meat cooked like the deer is highly prized, and especially the paws.

The smaller animals, mink, marten, etc., are skinned, skewered and stuck up opposite a good fire to roast. Their meat was not bad. Birds, after removing their feathers, are spitted and roasted like the animals. They were very palatable. Seal oil is the condiment used with all food. It is eaten with the fingers, and each finger dip is followed by several mouthfuls of food.

Nothing is cultivated for food, so recourse is had to the natural productions of the soil, principally roots, buds and berries, eaten raw and prepared in different ways. Most of the roots are stringy, and are boiled before eating, though for want of time and fuel they are sometimes eaten raw.

Among the most common roots used for food are: the mashoo, tasting like the sweet potato, eaten raw and boiled; the arcot, like the mashoo, but of different smell and less liked, prepared the same way; ka-ka or pick-neck, a grass root around lakes and in damp places, boiled; karga-neck, a small ground root, boiled; koat-le-ruck, a plant, leaves and stems, boiled; ar-ku-toak-puck, a mountain plant, roots eaten raw; ko-ong-oo-lick, a plant put up in oil, kept for winter, eaten raw; ish-u-a-muck, kept for winter, eaten boiled; pil-lun-wick, a plant found around lakes, only the roots eaten, raw or boiled; mis-suck, the young willow, the buds are mixed with oil, eaten raw summer and winter; oueyelalookmissun, the juice of the birch drunk as it comes from the tree; narkoowick, a sea-weed, boiled and eaten with oil—to eat this raw would make one cross-eyed, hence its name.

The berries, of which great quantities are gathered, are put away for winter use. They are sometimes preserved in either seal or deer oil according to which is on hand. The deer oil is easily obtained in the mountains, the seal oil on the coast. Seal oil they prefer, though to my taste there was but little difference. The berries used are: arc-pu, the salmon berry, eaten raw and in oil; as-se-yer-wick, the whortleberry, eaten raw and with oil; oak-py-ge-wick, the currant berries; ig-ge-wing-wick, rose berries, seed and all eaten; kip-my-ye-wick, small red berries growing on low bushes, boiled and eaten with oil; tar-ted-e-nim-as-se-ark, small red berries, put up and eaten with or without oil; too-look-come-as-se-ark, kind of whortleberries growing on large trees occasionally eaten with or without oil; pow-ner-ark, a small berry growing close to the ground, eaten raw or with oil; cub-lack, black berry, eaten raw or with oil; aug-ook-wick, a red berry eaten raw and with oil. Berries are eaten before the regular meal and constitute a course. Natives have lived on them exclusively for five days, but only through necessity.

The natives of Issheyuk on the Colville, eat a white clay at times. There is also an edible clay found in the Putnam valley. It is eaten by mixing with oil, berries and leaves. Some of this clay I found at the coal deposit. It was tasteless and easy to swallow. It is only taken when short of food. Food is cooked in iron kettles bought from the traders. Otherwise a clay pot from the Selawik country is used.

Feasts are given at certain times, when natives from all the surrounding country come together. Eating is the first object of these entertainments and dancing next. Often a bear is boiled in a wooden trough, the water being heated by throwing in hot stones. Wooden spoons are used but fingers are preferred.

Tobacco.—Tobacco is used to excess by both sexes. It is taken as snuff; chewed and the juice swallowed, and is smoked. The smoking pipe is a small metal or wooden bowl with a long thick, carved stem of ivory, bone or wood. A small pinch of tobacco mixed with a little deer hair is placed in the bowl, three draws empty it. The smoke is taken into the lungs and kept there some time, producing exhaustive attacks of coughing resulting frequently in complete prostration. This is not objected to and is repeated about every hour of the day and often during the night.

The stronger the tobacco, the more it is relished. One of the first instructions to children is how to smoke and chew. It is customary for the mother to take her babe from the breast and put her pipe or quid of tobacco in its mouth.

Fires are lighted by flints and steels; a kind of cotton is used as tinder. It is gotten from the willow and rendered more inflammmable by soaking in a gunpowder solution.

Native Astronomy and Time Reckoning.—It is held by the natives that the sun stands still and the world goes around it for the reason that the sun at stated periods appears always in the same place. The sun always produces heat; but its great distance from the earth during the winter prevents the heat reaching it. The moon moves and produces cold. The stars are stationary. The "Great Bear" called Toot-to-go-roak, like a big deer, is their favorite constellation and its motions are carefully watched. It is used to indicate direction. The morning star, Ar-go-roak, a favorite, is of use on account of its time of rising. Shooting stars, Ig-neck-pal-luck, are noticed but serve no purpose. They measure time by sleeps and moons. The number of sleeps in a moon is not known, one day is a sleep. A moon is a month and there are thirteen of them in a year. The first, which was in January (1886), they called Shack-kin-na-che-uck, because the sun is coming back. The second moon, She-con-na-shug-u-ruck, because the sun has high altitude. The third moon, Ku-she-wuck-tag-gu-wick, because the snow begins to melt. The fourth moon, Kel-ler-rick-tut-ker-at, because the owl (Kellerick) first appears. The fifth moon, Tong-me-ret-tut-ker-at, because the geese (Tongmeret) come. The sixth moon, See-kur-ur-gu-wick, because the ice (Seekur) begins to break. The seventh moon, Ir-ger-ne-wick, because the birds lay eggs. This moon is also called Et-cher-wick, the birds are moulting and cannot fly. The eighth moon, Neg-ga-lar-lig-it-et-char-re-at, because the young geese (Neggalarligit) cannot fly and the old geese (Etcharreat) have no wing feathers. The ninth moon, Ar-make-uk-se-wick, because the deer horns have velvet on them. The tenth moon, Ar-rup-tut-ker-at, because the water begins to freeze. The eleventh moon, Nue-le-ar-gu-wick, because the deer cohabit (nuele, wife, arguwick, deer). The twelfth moon, November, Nue-ge-ru-erk-see-wick, because horns drop. The thirteenth moon, Pon-dru-wick, because the sun cannot be seen.

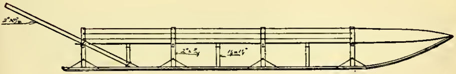
CONCLUSION.

As stated previously, the U. S. Revenue Cutter Bear had anchored off Cape Blossom on July 20, during my absence at Selawik lake. Arrangements were then made for her calling again later and taking us home. On Aug. 9 we loaded the boats and began moving from Camp Purcell to Camp Relief at Cape Blossom on Kotzebue sound, to await the arrival of, and be ready for transfer to the relief vessel. Bad weather interfered so that camp was not thoroughly established until Aug. 18. Aug. 23 the "Bear" again came to anchor off Camp Relief. Ensign Howard and his Point Barrow party were on board, all well. The next day the work of embarkation was begun and by the night of Aug. 25 all hands and all stores were on board. We hoisted in the "Helena" but decided to tow the "Explorer" astern. Aug. 26 the "Bear" sailed for Behring strait and the south, arriving at St. Michael's Aug. 28. Here I left Aloka, the interpreter, Bill and Riley, and their families. We hauled the "Explorer" up on the ways by laying timbers on the beach and using tackles, and I sold her, according to instructions, to Chas. Peterson, of St. Michael's, for $2000. On Sept. 4, the "Bear" left St. Michael's, and ten days later anchored in Ounalaska harbor. I rated the chronometers and we left on Oct. 10 for home. I arrived at San Francisco Oct. 21 and reported at Mare Island Oct. 25. Nov. 9, 1886, the "Northern Alaska Exploring Expedition" was put out of commission, and I was ordered to report to the Secretary of the Navy.

The Northern Alaska Exploring Expedition was in existence one year, six months and fourteen days. From the time we landed from the "Viking" until we went aboard the "Bear" on our return trip, we were four hundred and eight days in the country, during almost every day of which time we were actively engaged in hard work, walking, rowing, tracking, surveying, housebuilding, sledging, etc.

Sledging excursions were out from the fort twice for more than a month at a time, during a total of two hundred and seventy-three days, covering some 3000 miles of journeyings.

During the whole period there was not an accident or a case of illness of any kind, though the life was one of unusual hardship and unceasing exposure, often in a temperature seventy degrees below zero. Each officer and man entered into the spirit and purpose of the work with cheerfulness and determination, and each and every one did his duty well, and in a manner worthy of the highest commendation, and I take this opportunity of again thanking them. Nor should the natives be forgotten. They were honest, willing and obedient, and of incalculable service to the expedition. I also again tender my warmest thanks to Captain M. A. Healy, U. S. R. M., commanding; Lieutenant O. Hamlet, U. S. R. M., executive officer, and the other officers of the U. S. Revenue Cutter Bear for their kindness and consideration shown to the officers and men of the expedition on our passage south with them.



SLEDGE.

TEMPERATURES ON THE PUTNAM RIVER, ALASKA.

July, 1885.	
Lowest temperature during month	32° F.
Highest " " "	70
Mean " " "	49
August, 1885.	
Lowest temperature during month	32° F.
Highest " " "	68
Mean " " "	47
September, 1885.	
Lowest temperature during month	5° F.
Highest " " "	69
Mean " " "	39
October, 1885.	
Lowest temperature during month	— 4° F.
Highest " " "	46
Mean " " "	16
November, 1885.	
Lowest temperature during month	—44° F.
Highest " " "	15
Mean " " "	— 9.5
December, 1885.	
Lowest temperature during month	—65° F.
Highest " " "	29
Mean " " "	—12.4
January, 1886.	
Lowest temperature during month	—70° F.
Highest " " "	31
Mean " " "	—13.5
February,* 1886.	
Lowest temperature during month	—65° F.
Highest " " "	26
Mean " " "	—22.5
March, 1886.	
Lowest temperature during month	—38° F.
Highest " " "	36
Mean " " "	— 3.8
April, 1886.	
Lowest temperature during month	—22° F.
Highest " " "	49
Mean " " "	13

* Mean temperature February 1st to 20th—33° F.

MAY, 1886.

Lowest temperature during month				14° F.
Highest	"	"	"	65
Mean	"	"	"	35

JUNE, 1886.

Lowest temperature during month				32° F.
Highest	"	"	"	74
Mean	"	"	"	49

NOTE.—During the month of December, 1885, in one hour the temperature rose 29° F, barometer remaining quite steady. This sudden rise in temperature was closely followed by a terrible gale of wind. The thermometer, not the barometer, indicates an approaching gale. It is dead calm when the thermometer stands low, and during the gales the temperature always goes above zero. The more sudden the rise of thermometer the harder the wind blows and the more quickly it hauls. One should watch the thermometer closely and get under shelter if a gale is coming; for neither man nor dog can stand these gales. You must be under shelter. Have seen it snowing—that is a fine snow falling—when there was not a cloud in the sky and very light wind. It is advanced by some that there was a higher wind that carried the snow from the mountain peak.

When the thermometer is minus, it is denoted (—).

The temperatures during the months of July and August were taken partly at Fort Cosmos and while at work on the river. The others were taken at Fort Cosmos and an accurate temperature taken every hour by spirit thermometers remaining outside. These were the best (registered) spirit thermometers, made specially for the government for Arctic observation.

A person can't be too much impressed with the importance of watching the thermometer. I would recommend that the spirit thermometer have the liquid colored, as the white liquid is hard to read. The thermometer should also be protected by a wooden case, leaving only the bulb exposed, and even that should be screened. My observations were the mean of three excellent spirit thermometers.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE TORPEDO-BOAT, DESTROYER, AND DEPOT.

By Lieut. O. W. Koester, U. S. N.

Two great points must be considered before we can have an efficient torpedo fleet: (*a*) efficient boats, (*b*) efficient personnel. In regard to an efficient fleet, it is at first necessary that a torpedo depot be at once established. This depot should be situated on some harbor south of, or near New York, or in fact in a climate where drills can be carried on daily, irrespective of the weather. At this depot should be machine and boiler shops, foundry, torpedo repair shops, air compressor room, store-houses, magazine, armory. Quarters for officers attached to the boats and barracks for their crews. No officer or man should be required to sleep or mess on board a boat except during the manœuvres of the torpedo fleet, or at certain other times as desired in order to accustom the men to life on a torpedo-boat. The depot should be supplied with a marine railway capable of hauling out boats of about 400 tons displacement, and another railway connecting with, and perpendicular to, the marine railway should be built, so that the boats when hauled out for repairs, or to be laid up, may be run clear of the marine railway and at the same time can be put into the water at very short notice. All shops and store-houses should be built close to this railway, as should also be the barracks for the crews. The depot should have a floating derrick capable of lifting 25 to 30 tons. Diving apparatus and skilled divers should be ready at the depot, and when not actually at work, could be utilized in instructing the crews of the boats. There should be a large coaling dock where at least five boats can coal at one time; and the coaling of all boats should be done by laborers from the torpedo depot.

There should be a good harbor near the depot where drills can be carried on. This harbor should have at least six fathoms of water, be free from strong tides and currents, and have, if possible, a sandy bottom. Torpedoes frequently fail to run, and if the above conditions do not obtain, much time will be lost in recovering them.

The boats should be of two types: (*a*) the destroyer, (*b*) the sea-going torpedo-boat. The destroyer should be from 300 to 400 tons displacement and have a maximum speed of 30 to 31 knots. The torpedo-boat should be from 130 to 140 tons displacement with a speed of 25 knots. All boats should be kept in commission constantly, not only to keep the men properly drilled in their duties, but to keep the boats in their highest state of efficiency. A boat laid up for any length of time, even if in an efficient condition, requires much readjustment and examination before she can again be placed in service where maximum speed is required. For instance, joints of various steam pipes will dry out and leak, valves will rust or get dirty and require overhauling, air compressors will have to be overhauled, etc., whereas if the boats be kept in commission this is looked after by the crews, and the boats are constantly ready for service.

All destroyers should be exactly alike in every respect as should also be the torpedo-boats. All should have twin screws and triple expansion engines of either the three- or four-cylinder type, preferably the latter; the engines of either type when running at maximum speed should not make over 375 revolutions per minute. When engines run at much over 350 revolutions per minute the chances of accident increase rapidly.

The type of engine and boiler should be decided upon with great care, taking into consideration first of all the efficiency of the boat as a whole, and when once decision is reached it should be rigidly and carefully carried out, so that boats of a certain type will be exactly alike in every respect to the minutest detail. This is absolutely necessary for efficiency, as men who have qualified for torpedo service will be at once available for duty on any boat, and time will not be lost in teaching men their duties. All parts of each type of boat will then be interchangeable, spare parts, tools and fittings can then be kept in store and ready for immediate use. All supplies can be kept on hand and both efficiency and simplicity obtains.

All spare parts should have a number, together with an initial designating to which department it belongs. For instance, E-5-1 would be a connecting rod, starboard engine, 1st or H. P. cylinder; T-2, a part of a torpedo, etc. These articles, as well as supplies, should be drawn from store without requisition, the commanding officer of the boat deciding what is necessary and receipting for same.

A type of valve gear for the main engines should be adopted, having the fewest number of moving parts, thereby greatly reducing the liability of accident. The efficiency of the entire boat must be considered above the efficiency of any special part, regardless of any special economy of that part. No torpedo-boat can be run with any great degree of economy, and the highest state of efficiency should be sought irrespective of any slight saving of fuel or supplies. The boat is not built for long distance steaming nor for comfort; and her steaming radius does not depend on the amount of coal she can carry, but upon the amount of fresh water necessary and the endurance of her crew. A torpedo-boat steaming at maximum speed uses about six tons of extra feed-water per 1000 H. P. per 24 hours, so it can be readily seen what an important item fresh water is. At a speed of 10 or 12 knots the torpedo-boat can generally carry fresh water to equal her coal endurance; that is, providing the evaporator is kept going constantly. The ordinary torpedo-boat cannot steam at full speed much over 4 hours before the water supply is exhausted.

All dynamos and anchor engines should be retained in the destroyers and removed from the torpedo-boats. The anchors of a torpedo-boat can be handled easily by the crews, and the engines in addition to heating up the meager living spaces of the crews, occupy valuable space and weight. Put the extra weight into the air compressor, rather than into a dynamo or anchor engine.

No deck gratings of any kind should be fitted on the boats of either type as they only add unnecessary weight. Supply the crew with rubber-soled shoes and the same result is obtained in a much more satisfactory way, and at the same time about a ton of weight is saved. Make the signal mast of ordinary brass pipe instead of wood, thereby saving much weight. The deck over the boilers should be secured with bolts, so that it may be easily removed and boilers can be hoisted out for repairs. A large hatch should be fitted over each engine, in order that proper ventilation may be obtained, and opportunity given for overhauling the engines.

In regard to the personnel. Each destroyer should be commanded by a Lieutenant, with two Junior Officers, one for deck duties and one for engineering duties. These officers should exchange duties every six months, so that they may qualify for any duty. A gunner should also be attached to a destroyer. All of the deck force should consist of gunners' mates and seamen gunners only; in this case each man of the deck force will understand the care and maintenance of the battery, torpedoes, and their appliances, and efficiency and simplicity prevail. In the education of seamen gunners it is absolutely necessary that they be trained in a machine shop, and all chief gunners' mates should at least be able to qualify as first class machinists. The engineer's force of a destroyer should consist of two warrant machinists, and a sufficient number of the following rates: chief machinist, oiler and water tender. No 1st or 2d class machinists nor 1st or 2d class firemen or coal passers should be on board. All machinists and men of the fire-room force should stand the same watch, the latter being required to attend water while on duty, and men doing the duty should have the rate and pay for same.

The torpedo-boat should be commanded by a Lieutenant, with a Junior Officer for both deck and engineering duties as his assistant. One warrant machinist should be attached to a torpedo-boat and all deck men should be gunners' mates and seamen gunners, while the engineer's force should consist of chief machinists, oilers and water tenders.

No man should serve on a destroyer until he has had at least three months of service on a torpedo-boat and has qualified for torpedo service.

Men who have qualified for service in the torpedo fleet should receive, while doing duty with the fleet, 25 per cent. extra pay of their rate, and wear some distinguishing mark on the sleeve. They should be supplied yearly with the following articles free of charge: 2 pairs of working clothes, 2 pairs rubber-soled shoes, 2 watch caps, one suit of oil skins (deck force), one pair gum boots (deck force).

All spare parts and supplies not used daily should be stored on shore, and weights kept down as much as possible in order that the boats may be kept at their designed displacements. In case any improvement be determined for a type of boat, these improvements should be carried out at once in the entire lot of boats, thus keeping the boats alike in all details as far as it is possible to do so. The most vital point of our torpedo service is frequently lost sight of—efficiency first, and economy second. Any appliance for war purposes, if good, is cheap at any price.

NOTE.—Discussion on this article is invited, to be published in succeeding numbers.—EDITOR.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON THE MARCONI WIRELESS TELEGRAPH.

By Lieut. J. B. Blish, U. S. N.

Last September Mr. G. Marconi, the inventor of a practical system of wireless telegraph, brought over from England three sets of his apparatus for the use of the New York Herald in reporting the international yacht races.

The Navy Department detailed four officers to observe the working of the wireless telegraph during the races, and then, the reports of these officers being favorable to it, accepted Mr. Marconi's offer to set up his instruments on board of ships of the navy and there demonstrate their seagoing qualities and the adaptability of his system to naval signaling.

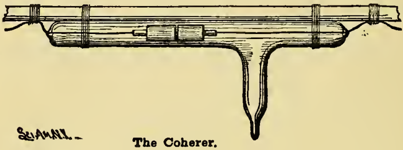
The three sets were installed on the flagship New York, the Massachusetts, and at the Navesink Highlands Light Station; and after a series of tests lasting over a week, three days of which the ships were at sea off Sandy Hook, the torpedo-boat Porter was fitted out with the apparatus from the New York, and spent a day steaming about the Massachusetts and off the Highlands for a further test.

Mr. Marconi then returned with his apparatus to England.

A board of three officers investigated the system during the navy tests, and in their report to the Chief of the Bureau of Equipment recommended that it be given a trial in the navy. During these tests the instruments were open to the inspection of the officers, except certain parts which were never dismounted; and their workings were explained in a general way, but the exact dimensions of the parts were not divulged.

The coherer, the principle of which was discovered some twenty years ago, is the only electrical instrument or device contained in the apparatus that is at all new.

Marconi's coherer, Fig. 1, is a glass tube about an inch and a half long, with a bore about one-tenth inch, into which are fitted two silver plugs, with leading wires attached. The space of about one-twentieth inch between the inner ends of the plugs is partly filled with a mixture of nickel and silver filings. The tube, after being exhausted to about one-thousandth of an atmosphere, is sealed. As shown in the figure, the coherer is seized to a glass rod for convenience in securing it in place in the receiver.



The Coherer.

FIG. 1.

In their normal condition the "imperfect electrical contact" of these filings offers an infinite, or nearly infinite, resistance to a current of low electromotive force, but when the filings are "cohered" their resistance falls to a few hundred ohms, and so remains until they are "decohered," when they instantly resume their non-conducting state.

This coherence is brought about by certain phenomena, which are attendant upon the production of an electric spark and which act through space; the "decohering" is done by mechanically shaking or tapping the coherer.

In the Marconi system a series of sparks produced at the sending station "cohere" the coherer at the distant receiving station, which closes a local circuit containing the coherer, a single cell and a telegraph relay, which closes another circuit containing the tapper and the registering instrument. The instant the sparking ceases, the coherer is "decohered" by the tapper, and both local circuits are broken. Thus the dots and dashes of the telegraph code made in the spark-producing circuit at the sending station are reproduced as short and long closings of the local circuits at the receiving stations, and are registered as dots and dashes on the tape.

This transmission seems to be instantaneous.

Marconi discovered that the distance of transmission was increased enormously by using vertical insulated conductors, both for sending and for receiving; in sending, the vertical wire is connected to one pole of the spark-producing instrument and an earth wire is connected to its other pole; at the receiver, the vertical wire is connected to one leading wire of the coherer, while its other leading wire is connected to earth. This arrangement, shown in Fig. 2, has transmitted signals 25 miles.

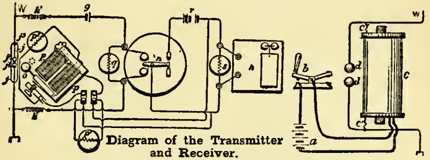


Diagram of the Transmitter and Receiver.

FIG. 2.

Later it was discovered that by replacing the coherer by the primary of a transformer coil and putting the secondary of this coil in series with the coherer, the distance of transmission was again increased manifold.

The Marconi apparatus of to-day is illustrated in Fig. 3, and is diagrammatically represented in Fig. 4, which is reproduced by the permission of the Chief of the Bureau of Equipment from the diagram contained in the report of the Marconi board and which Mr. Marconi pronounced to be correct.

Referring to this diagram:

A is a sheet-iron box, 1/20-inch thick, about 24 inches long, 8 inches wide, and 8 inches high, containing the transformer MM^1, coherer *j*, tapper *p*, relay *n*, relay cell *g*, and battery *r*, for the tapper and register circuits. There are usually two of these receiver boxes at each station; one adjusted for long range work, and the other for shorter ranges. They are connected to earth by the wire from *E*. The box shields the receiving apparatus from all outside electrical influences, except that brought in by the receiving wire.

a is the sending battery, giving a current through the primary of the sending coil, *w*, of about 6 or 8 amperes, at about 17 volts.

The current may be taken either from a battery or from a dynamo circuit, direct or transformed, but usually a storage battery of 8 cells in series is employed on account of the steadiness of its current. This may be recharged from time to time, but continuous charging by a dry-cell battery of slightly higher E. M. F. has been found to give the best results. For this purpose a battery of 98 Obach dry cells, arranged in 7 rows in multiple and 14 in series, is joined in multiple with the storage battery.

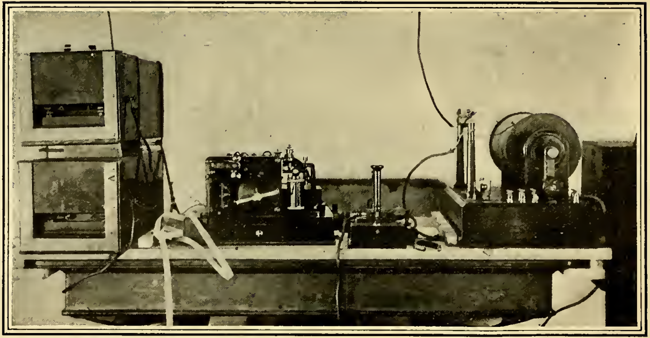
b, the sending key, differs from an ordinary telegraph key in having a very long gap between its contacts, made necessary by the large sparks produced between them by the self-induction of the heavy current. These contact points are large and the rubber handle of the key is long. The back-stop of the key connects the vertical wire, *H*, to the receiver, so that after "calling" a station or sending a message by merely letting go of the key, the receiver is connected up ready to take down the answer or acknowledgment from the other station. This automatic connection is seldom used, however, it being preferable to shift the vertical wire by hand from the sender to the receiver.

The limit of speed in sending with this key, is about twelve words per minute; to send faster than this the vertical movement of the key must be shortened, and if shortened too much, the spark is not broken when the key is raised, which not only sends a false signal, but scores up the contact points until they either fail to make the next contact, or making it, they weld together and stick.

During the time that the circuit is closed at the key, the primary current is made and broken at the rate of about forty times per second by the spring circuit-breaker and sparks pass between the ball terminals, *e*, of the secondary of the coil, *W*.

This coil, known as App's 10-inch coil, is similar to the Ruhmkorff coil, and contains the condenser, *Y*, in its base. One of the terminal balls is connected to earth at *E;* on board ship this connection is made to the hull and must be well soldered. The vertical wire is connected to the other terminal.

The distance between these balls is varied from a half-inch to an inch; the range of transmission seems to increase with the length of the spark, but the sending must be done very slowly when the distance is greater than eight-tenths of an inch, otherwise many of the dots will fail to produce any spark at all. Any



From Harper's Weekly.

FIG. 3. THE MARCONI APPARATUS.

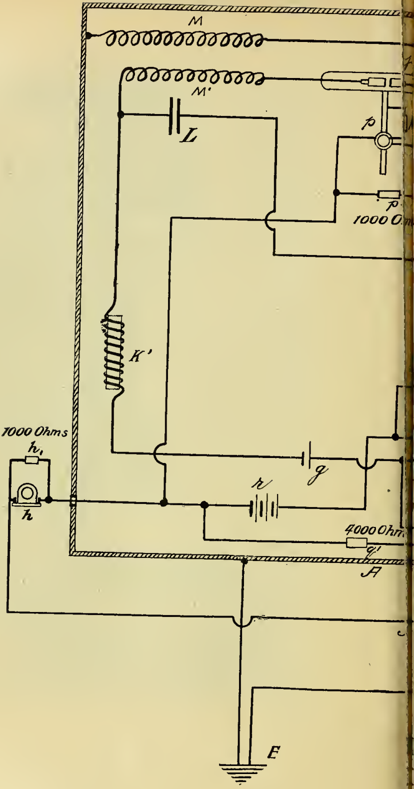
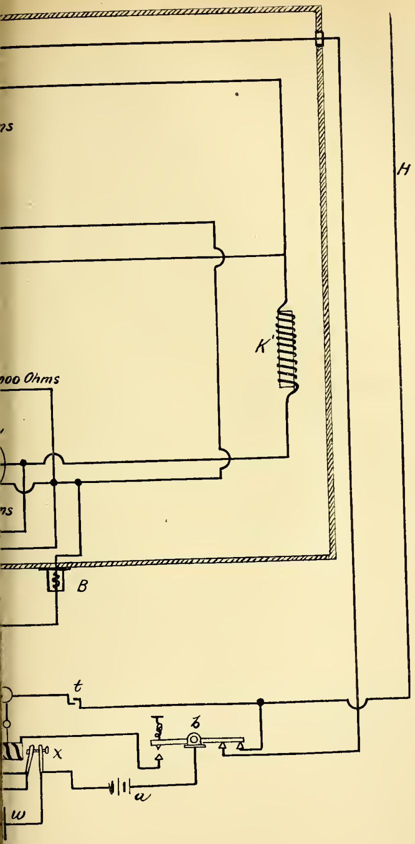


FIG. 4 CONNECTIO



LESS TELEGRAPHY.

serious leakage from the coil or the vertical wire is indicated by the character of the spark; if a dead earth occurs no spark is produced at all, as the secondary circuit is then completed through the earth. A sharp crackling sound indicates the best spark. The sparks seem to pass always in the same direction, and one terminal becomes warm from sending, while the other does not change its temperature. The direction of the primary current through the coil is sometimes reversed in order to equalize the wear on the contact points of the vibrator.

The vertical or aerial wire was made up of seven copper wires, each 1/25-inch diameter and covered with rubber insulation. The upper end had an eye spliced in it, to which was secured a string of three or more round sticks of ebonite, each about 18 inches long and 1 inch thick, with holes in their ends for lashings. Sometimes the upper end of the wire was bighted up in several lengths of about two feet, and sometimes it was coiled up in a few turns of about one foot diameter; but no particular attention was paid to that part of it.

A temporary wooden mast was sent up and lashed to the topmast and fitted with hemp or manila rigging. A sprit about 18 feet long was hoisted to the truck of this mast by halliards bent on at one-third its length. The short end was steadied by a down-haul and the wire was triced up to the long end by halliards bent on to upper ebonite sticks, so that the upper end of the wire was above all metal masts, lightning conductors and wire rigging, and as high as it could be got. The wire was led away from the mast, keeping it clear of rigging, smokestacks, davits and the like, to a hatch or skylight; wherever it changed direction, guys of ebonite sticks were bent on to keep it in place, and where it went through a hatch, skylight, bulkhead or door, a rubber tube was used to lead it through. The matter of insulation of this wire is very important; in damp weather the number of ebonite sticks in the various strings must be increased. Sometimes these wires have been led down through the ventilators.

It is believed that the distance of transmission depends upon the vertical component of the aerial wire and varies as the square of the height of the upper end of the wire above the instruments, or above the hull of an iron ship when the instruments are placed below the upper deck.

During the navy trials this height on the New York was 130 feet, on the Massachusetts 140 feet, at Navesink 150 feet, and on the Porter 45 feet.

The height of a shore station above the sea-level or above the surrounding country does not seem to affect its range.

A person touching the wire when it is transmitting receives a severe but not dangerous shock.

The spark at the coil, or even one produced by a bad leak from the wire to earth, would set fire to an inflammable mixture of gas or other easily ignited matter.

There would seem to exist a danger of lightning being conducted below by the wire, but as it offers an unbroken metallic path to earth, possibly, by continuously discharging during an electrical atmospheric disturbance it may act as a protection from lightning. No casualties have been reported from lightning. Atmospheric electricity has been known to cohere the coherer, but the occurrence was never sufficiently frequent to prevent signals from being read.

The receiving wire takes up the impulses sent out by the sending wire and transmits them through the primary, M, of the transformer to earth.

The transformer is of the "step-up" type, the secondary coil being longer than the primary, so that the impulses induced in the secondary coil, M^1, have an increased effect on the coherer. To prevent their passing through the relay coil into the battery and there being dissipated, the choking coils, K^1K^1, are placed in the circuit and an alternative path through the condenser, L, is provided. The choking coils are made of fine insulated wire wound on iron cores, and are known to impede an alternating current. The condenser, L, prevents the relay current from being short-circuited around the coherer, but seems to offer no resistance to the passage of the induced impulses.

The transformer and the condenser, L, were contained in a small wooden box about 7 inches long, 1½ inches wide, and 1½ inches high, fitted with from 5 to 8 binding posts. This box, known as the "jigger," was never opened. Sometimes a small additional condenser was connected up outside of the "jigger."

When the coherer is cohered the relay circuit is completed, and the armature of the relay is drawn over against its stop, and there completes the two parallel circuits from the battery, r, one through the tapper and the other through the Morse register or ink-writer, ***h***.

The tapper has a spring armature like that of an electric bell, and its hammer strikes the coherer a series of rebounding taps. When the impulses cease the next stroke of the tapper decoheres the filings and breaks the relay circuit when the spring of the relay pulls its armature back and so breaks the tapper and register circuits.

The Morse register or ink-writer is of a commercial pattern and prints the dots and dashes on a tape, reeled off by clockwork.

Across the coils of the relay, tapper and register are the non-inductive shunts, q, p^1 and h^1. These consist of fine insulated wire wound " on the bight " on wooden bobbins, and their office is to short-circuit the high potential currents induced in the coils when the battery currents are broken and so prevent their affecting the transformer or the coherer.

The non-inductive shunts, q^1 and p^2, across the contact points of the armatures of the relay and of the tapper, are to prevent the sparking which would otherwise take place there when their currents are broken.

The shunt, n^1, containing the condenser, L^1, is also placed across the contact points of the relay, but its action was not explained.

The leading wires from the back-stop of the key and from the ink-writer are the only ones that enter the receiving box, and to prevent them from transmitting the effects of the sending spark to the receiver at the same station, special devices are employed. The wire from the key is lead-covered, and the lead is soldered to the box where the wire enters. The ink-writer wire enters at *B*, which is an extension on the box containing a choking coil, each layer of which is covered with tin-foil in metallic contact with the box. The other leading wire is itself connected to the box.

The exact dimensions and the proper construction of all these devices have been arrived at by experiment, and the result is a complete and successful system of wireless telegraphy which has been thoroughly tested, during the past year, afloat and on shore and under various conditions of weather. The greatest distance yet covered by it is 110 miles, from Chelmsford, across the English Channel, to Boulogne. The greatest distance signaled across between two ships at sea was 72 miles, during the British manœuvres. There are a number of permanent shore stations in England and the East Goodwin Lightship has been in communication with the South Foreland Lighthouse, 12 miles distant, since Christmas, 1898.

The instruments brought over to this country were not expected to work over about 25 miles during the races, but when put on board the New York and the Massachusetts, they kept up communication for 36 miles at sea, and the Massachusetts read the New York's signals at about 45 miles. The Porter read signals 7 miles from the Massachusetts, and the Massachusetts read the Porter's messages 8½ miles.

Each station receives all signals made within its range, and if two or more send at the same time, the receiving tape is illegible. So that if a ship got within range of an enemy's fleet she could not only read their signals, but, by working her transmitter continuously, could prevent the transmission of signals between the ships of the fleet.

Experiments looking towards the prevention of this interference have been made with partial success, but as it stands to-day interference cannot be prevented.

Another system, based on the use of metallic mirrors without vertical wires, has been developed, but its greatest range being about 1¾ miles it is not adapted to fleet signaling.

The newspapers report that the Marconi system has been adopted by the British army in South Africa and by the British navy; the hulk Hector is to be fitted up at Portsmouth for the instruction of signalmen of the navy.

The incorporation of an American company, controlling the Marconi patents in the United States is also reported.

If adopted by our navy, the care and operation of the apparatus would require about the same intelligence, education and length of special training as are now required for the electric plants on board ship, and a school of instruction should be established as soon as it is decided to adopt the system.

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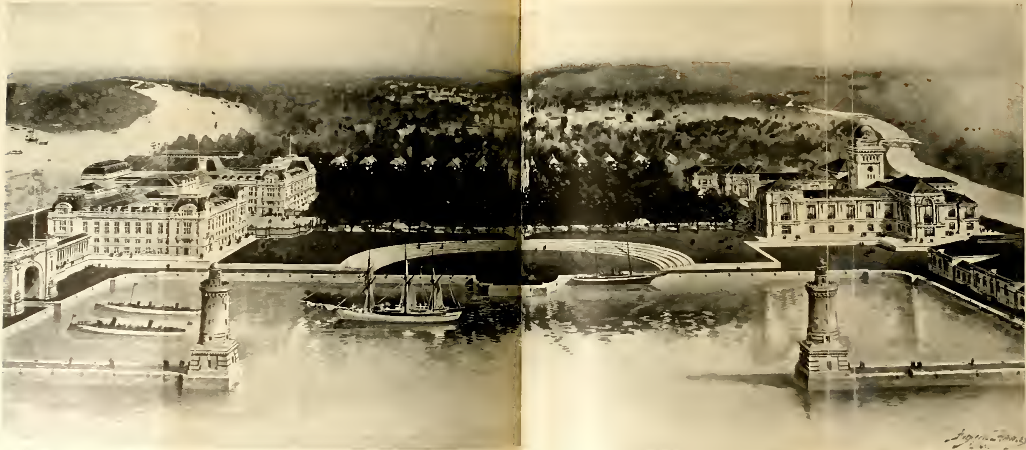

TEPS PHYSICS & CHEMISTRY ACADEMIC BUILDING STEAM BUILDING POWER HOUSE

THE NEW N ACADEMY

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NEW NAVAL ACADEMY.

By ERNEST FLAGG, Architect.

The Naval Academy was founded in 1845 when George Bancroft was Secretary of the Navy, and was then located where it is to-day, at Annapolis, Maryland. Some buildings connected with the military post attached to old Fort Severn were pressed into service, and from time to time other buildings were added to them. The old fort stands on the point at the mouth of the Severn river. It is a curious little round structure, having immensely thick walls and a protected entrance from the land side. In recent years a one-story wooden structure has been built on top of the old walls, and the fort now does duty as the gymnasium of the academy. Formerly the water almost washed its base, but from time to time land has been reclaimed from the river, and the structure now stands some distance inside the sea wall. Under the proposed scheme for remodeling the academy, more land will be reclaimed by extending the sea wall on the bay side out to the Port Wardens line and the fort will be thrown still further back. It is proposed to restore this little historic relic to its original appearance, and to mount upon it the old guns, in which condition it will form an interesting feature of the parade ground, and will present a striking contrast to the proposed new practice battery on the point.

From time to time the Government has acquired more land about the old reservation. One of the most important of these acquisitions was the purchase of the grounds with the mansion of the colonial governors of Maryland. The old building still exists and is used as the library of the academy. It has, however, been sadly transformed during the last hundred years. It has been shorn of its wings, in which were the slaves' quarters, the old porch has been removed from the front and replaced by one not in character with the building, and a heavy new roof has been added, which almost entirely robs the exterior of its former beauty. One roof was burned off. There seems to be no record of the time of this occurrence, but the writer, upon making an examination, found the remains of three roofs, one of which had been very much damaged by fire. The successive roofs have been built one over the other, and it is therefore hardly to be wondered at that the last one looks heavy. The proposed scheme for rebuilding contemplates the restoration of this interesting and historic relic to its original condition, and utilizing it as a residence of the commander of the place, who is known officially as the superintendent. Those who have read Richard Carvel will doubtless remember several references to this old building. When restored it will add greatly to the beauty and interest of the place.

With the exception of the governors' house, and the old fort, there are no buildings of any interest or beauty on the grounds. All are old, poorly built, and many of them are much out of repair. Some have recently been condemned as unsafe, and several have been torn down for this reason. It seems to have been the policy of the Government to build here in the poorest way, and to place the buildings wherever there was a vacant place, with absolutely no regard to the convenient and economical working of the institution. Thus, the armory, which now has one side shored to keep it from falling out, is in a most inconvenient place, almost as far from the parade ground as the limits of the yard will admit, and much time and labor are lost daily in marching and hauling guns by devious paths back and forth between it and the parade ground whenever there is a drill. The recitation buildings seem to have been located by chance, and the boat house, a part of which was condemned as unsafe within five years after it was built, is in a most inconvenient position with regard to the cadets' quarters.

In the scheme for rebuilding, it has been the endeavor to place every building in the location best adapted to it—where it will fit in most advantageously for the routine work of the institution, and most harmoniously from the artistic standpoint.

The flimsy character of the old buildings was amusingly illustrated in a story which Admiral Matthews (chairman of the committee which recommended the proposed scheme for rebuilding) told of an experience of his when a boy at the academy. One night when he and some comrades were studying in their rooms in one of the old buildings, they suddenly heard a rumbling sound, the lights were extinguished, there was a rush of cold air, then a terrible crash. One side of the building had fallen out, leaving the rooms open on the side toward the water. Fortunately the floor beams did not rest on this wall, or the admiral would probably not have been alive to tell the story. As it was, the young men found themselves sitting on a shelf in the open air. Recently one of the buildings of this same row was found to be split in two from top to bottom. The two halves seemed to be only held together by the weight of the roof, and it was necessary to rig up great spars and tie the building together with ropes before it could be taken down. In spite of the flimsy character and unsightly appearance of many of the buildings of the academy, the place is attractive, and can hardly fail to produce an agreeable impression upon the visitor. The grounds are always in the most immaculate order. The well-kept walks, fine trees, smooth lawns and beautiful outlook over the bay, all combine to make a most attractive picture and to indicate how beautiful it can be made when all its natural beauties are brought out and the blemishes removed.

The Government owns three pieces of property, comprising several hundred acres, which are more or less disconnected, but which are set apart for the purpose of the academy. The principal one of these, and where it is proposed to place all the new structures, adjoins the town of Annapolis and occupies the point which is formed by the southern bank of the Severn river, where the latter meets Chesapeake Bay. It has a frontage on the bay of about 1200 feet, and a frontage on the river of about 2400 feet. These two water-fronts form an acute angle, so that the property is wider at one end than it is at the other. This would not be so if the sea wall along the river followed the true line of the stream, for the channel of the river makes almost a right angle with the Port Wardens line along the bay side. In the scheme for rebuilding, it is intended to reclaim some part of the flats on the south side of the river by building a great pier, upon which will stand the power house, storage warehouse and steam engineering building, and to dredge out the rest of the shallow area so as to form a basin for the practice boats of the academy; the basin to be partially enclosed by piers following the true line of the river; this will square out the property and bring it almost to the form of a rectangular quadrilateral, having a breadth of 1284 feet, and a length of about 2500 feet. The basin will have a length of 1083 feet and a width of 580 feet. It is proposed to build a fine new sea wall of massive masonry along all this water-front and around the basin.

The academy has two main entrances which stand at the head of two of the streets of the town. Another street at right angles to these runs along the wall. When one enters he faces towards the Severn river. At present the view of the river, which is very pretty here, is obstructed by a row of unsightly coal sheds and wooden buildings which line the water-front. It is proposed to remove all these and to open up a charming view of the river, with the basin in the foreground, the latter enclosed with massive sea walls of granite, its entrance flanked by stone beacons standing at the ends of the two piers which partially separate it from the river; and the shipping along the quays will produce a striking and characteristic effect. On the southerly side of the basin advantage has been taken of the natural lay of the land to broaden out the quay into a sort of semi-circular place suggestive of an amphitheatre, with concentric rows of broad steps on the banks, which represent the difference in grade between the made land of the quay and the solid ground of the campus. This place will have a length of 415 feet and a width of 250 feet. It is intended for use at out-of-door exercises. The band stand is placed at the center of the side toward the basin. A great multitude could be accommodated on the steps or gradients of the amphitheatre. The fine old trees now on the campus are to be preserved, the lawns extended toward the river, and the parade ground greatly increased by moving the sea wall on the bay side out to the Port Wardens line.

When the proposed plan is carried out the buildings will be in three main groups, one on each of the three sides of the campus, on the other side of which is the basin with its shipping. The cadets' quarters will be on the right hand side as one enters from the town, the academic buildings on the left, and the officers' houses, as at present, on a line parallel to and just inside the wall which encloses the academy grounds on the side towards the town. The cadets' quarters will stand between the campus and the parade ground. It will be flanked on one side by the boat-house and on the other side by the armory. The main floors of these two latter buildings will be at the level of the parade ground, which, being of made land, is lower than the campus. The cadets' quarters will stand on the higher level, and the difference in grade between the campus on one side and the parade grounds on the other will be made up by a stone terrace about 18 ft. high on the side towards the parade ground, so that the quarters will appear to stand on a terrace when viewed from the parade ground or from the bay.

The boat-house and armory are to be connected with the cadets' quarters by covered ways. The northwesterly end of the boat-house abuts upon the basin, and the main longitudinal axis of the building and the basin coincide.

The academic building at the other side of the campus faces the cadets' quarters; the main axes of both these buildings coincide. They will be connected by a broad avenue of trees. The academic building is flanked on one side by the physics and chemistry building, and on the other side by the steam engineering building. The latter, with the power house and general storage warehouse, form a group which will stand on the reclaimed land at the northwesterly end of the basin. The power house, which is the central building of the three, will face the boat-house at the other end of the basin. Their longitudinal axes coincide with that of the basin.

This general plan, that is to say, the grouping of the buildings, and arrangement of the grounds, and the treatment of the water-front, was prepared by a commission appointed by Secretary Herbert, pursuant to a resolution adopted by the Board of Visitors to the Naval Academy of 1895, requesting the Secretary to appoint a commission "to examine and report upon the condition of the grounds and buildings and the sanitary condition of said Academy." The following extract is from the report of the Board of Visitors:

"The Board feels that the Naval Academy should be an institution second to none of its kind in the world; that it should meet every modern requirement as an institution of learning, not only as to the instruction given, but as to the conveniences and accommodation offered officers, instructors, and cadets. It feels that the present buildings are insufficient and inadequate for the purposes to which they are assigned, and that a reconstruction of buildings, grounds, and sanitation, upon the most approved modern architectural and sanitary lines, will not only be an incalculable benefit to the naval service, but a progressive step which will meet the approval of the whole country."

A commission was appointed by the Secretary of the Navy, July 5th, 1895, and consisted of Admiral (then Commodore) E. O. Matthews; Captain P. H. Cooper, U. S. N. (then superintendent of the Naval Academy); Lieutenant-Commander E. H. C. Leutze, U. S. N.; Lieutenant-Commander A. Ross, U. S. N.; W. R. DuBose, surgeon, U. S. N.; and W. P. Potter, Lieutenant, U. S. N., recorder.

An extract from the report of this commission reads as follows:

"The Board met at this place on July 16th, 1895, and made a careful inspection of the buildings, grounds and sewerage system. After examining into the needs of the service for which the buildings were erected and the present arrangement and conditions, we find the present buildings are, with few exceptions, in very bad condition and not warranting the expense of the extensive repairs that would be needed to render them safe and serviceable, which repairs would only be temporary, and even then they are so misplaced as to be very inconvenient; others, though now in fairly good condition, will soon begin to require unending repairs, and are so misplaced as to interfere with any proper general plan.

"Owing to the extensive flats surrounding the water-front, which are either exposed at low water or very near the surface, a proper sewerage system is almost if not quite impossible under the present conditions, and the Board, looking to the permanent needs of a great and growing nation, is of the opinion that in the interest of true economy and efficiency, a plan should be adopted for the erection of substantial fireproof buildings of indestructible material, properly arranged and situated, to be convenient, healthful, and thoroughly adapted to the requirements of an institution that is to last for all time.

"Before the erection of the new structures can be commenced the Board deem it of prime importance to install a permanent sanitary sewerage system and to prepare the grounds. This can only be accomplished by raising existing ground along the water-front and filling in in other places. For that purpose, and at the same time securing sufficient depth of water-front for the handling of boats and vessels used in instruction, dredging should be commenced and a suitable sea wall built."

When the board was appointed it was directed by the Secretary of the Navy that its report be accompanied by a map of the buildings and grounds as now constituted, and also a map of the buildings and grounds as they will appear under the system to be proposed by the board.

A great deal of time, study and care were given to the preparation of this latter map or general plan. The commission met many times on the grounds and carefully considered the needs of the institution and the proper location of the new buildings. Mr. Ernest Flagg, architect, of New York, was invited to assist in the preparation of a plan which should embody the ideas of the board, and his plan was submitted with their report.

The reasons which governed in the preparation of this plan were briefly these:

The area of the grounds was thought to be too restricted. To overcome this and at the same time to deepen the water along the sea walls, it was proposed to reclaim flats which lay under water on two sides, and to obtain the necessary filling by dredging out a part of the area for a basin. By thus raising the general level and deepening the water, the difficulties in the way of the installation of a proper sewer system would also be overcome. In placing the buildings it was thought that as the institution was chiefly for the benefit of the cadets, the cadets' quarters ought to occupy the best and most commanding location on the grounds, that is to say, the site of the present superintendent's residence. There were also other weighty reasons for the selection of this location for the quarters, the most important of which was its proximity to the parade ground, which is admirably located inside the sea wall on the bay side. By placing the boat-house to the northeast of the cadets' quarters, and the armory to the southwest of it, all three of these buildings would be located in the most advantageous positions with respect to the grounds and with respect to themselves. The armory would be contiguous to the parade ground, the boat-house to the basin, and the quarters within convenient reach of each. To still further facilitate communication between these three buildings, it was determined to connect them by covered ways. It is generally necessary that the cadet should change his clothes preparatory to duties on land or water, it is therefore desirable that the quarters should be within reasonable reach of the boat-house and armory. The plan adopted accomplishes this purpose admirably.

The officers' houses were thought to be well located in their present position, and that when the cadets' quarters are placed on one side and the academic building on the other side of the square upon which they face, no more convenient location could be desired.

The old governors' mansion, which it was desired to preserve both for historical and artistic reasons, seemed to be admirably located for a residence for the superintendent, standing, as it does, at the head of the row of officers' houses. It was thought best to attach the library to the academic building, so that it should be within easy reach from the class-rooms of the various departments. It was placed to the west of and adjoining the academic building, from which it is separated by enclosed courts. The physics and chemistry departments, and the department of steam engineering, each requires separate buildings; these were placed one at either side of the academic building. It was also thought desirable that the steam engineering building should be closely connected with the power house, so that power can be easily transmitted to it, and so that the apparatus of the power house itself might be used for illustration and instruction.

This disposition of the buildings not only has the advantage of bringing every building into the place most convenient for it, but also of placing them where they will produce a fine artistic effect and not interfere with the natural beauties of the place.

Although the report of the Matthews commission was presented January 16th, 1896, no action was taken by the Department until 1898. When the report was made Secretary Herbert thought that, in the then condition of the national finances, Congress would not be likely to enter upon an undertaking of such magnitude as that suggested by the Matthews board. In 1898 the recitation building was found to be unsafe, the Department concluded that something would have to be done, and Congress was asked to make an appropriation to commence the work in accordance with what was known as the "Matthews plan." Although the sum asked for was stricken out in committee, the House, upon motion of Mr. Mudd of Maryland, agreed to an amendment appropriating $1,000,000 to be applied to the erection of the boat-house, the armory, the power house and a part of the sea wall; $500,000 of this sum was not to be available until the following year. At the next session the secretary was asked for a further sum to commence work on the other buildings, and although committee again failed to include any part of the amount asked for in the bill reported to the House, Mr. Mudd again secured by amendment the appropriation of $720,000 for the work already authorized; $220,000 of this amount was rendered necessary by the determination to make all the buildings of granite instead of brick and limestone as originally contemplated. The plans had been prepared by Mr. Flagg in accordance with the Matthews report. Bids for the work were advertised for and contracts for it were finally made with P. J. Carlin & Co., of Brooklyn, N. Y. The work was commenced March 28th, 1899, and has been in progress ever since. It is expected that the buildings now under erection will be completed in about a year. The Department has asked the present Congress for upwards of $2,000,000 to continue the work upon other buildings of the plan.

DISCUSSION.

"WATCH, QUARTER AND STATION BILLS." See No. 90.

Captain NICOLL LUDLOW, U. S. N.—I commanded the Massachusetts for some nine months or so until June 1st, and Commander Schroeder was the executive during the greater part of that time. The Watch, Quarter and Station Bills of Commander Schroeder I found in use when I assumed command and I found no necessity to make any change whatever in them, neither could I suggest any improvement. The men seemed to readily comprehend them; and this was especially observable, as many new men were coming in as the times of service of the old men expired. I have had considerable experience in making out these bills in times gone by and regard the work of Commander Schroeder as nearly, if not quite, *perfect*. I can suggest nothing to improve on his work and hope that these bills, which are readily applied to any class of vessel, will be made the standard Watch, Quarter and Station Bills of the navy.

Lieutenant ALBERT GLEAVES, U. S. N.—An old sailor recently excused himself for not handling his piece properly by saying, "They changes the drill on me every time I enlist."

It is a common experience that officers returning to sea duty after a tour of two or three years ashore are similarily embarrassed before they have learned not only the new drills, but the new routine, the new duties, the new nomenclature, and even the new uniforms of the chief and other petty officers.

The craze for change is epidemic and demoralizing and it should be discouraged.

There seems now to be no further reason why an organization should not be adopted by regulation and issued to service so arranged in blank as to be applicable to any class of vessels from a gunboat to a battleship, and that proposed by Commander Schroeder seems to be preferable, not only because its flexibility lends itself readily to contraction and expansion, but because it has been proved successful and satisfactory.

In regard to organization, generally speaking, no watch number should exceed three figures; any information that cannot be imparted by three figures can be better obtained in other ways.

It does not seem wise or reasonable to charge the division officer with the care and preservation of the hull. The care of the ship inside and out, properly and legitimately, belongs to the executive officer.

There should be a separate navigator's division. The navigator's detail, so called, when scattered among the gun divisions adds a fictitious strength only to the division, as they are rarely present at drill or at any other time when they are wanted, there being always a good excuse why they should be somewhere else.

The running and fighting boats' crews should be the same. As it is not desirable to make the fighting boat, when drawn from one division, the running boat, the running boat's crew taken from all parts of the ship should be made the fighting crew. Any objection to this seems to be more than offset by its many advantages. It is not essential that an officer's fighting boat's crew should be the same as his gun's crew, nor is it highly important that his boat should be near his gun; at most it cannot be more than three hundred feet away. There are advantages in bringing an officer into contact with as many men as possible, and it should be as easy to man and arm a boat in one place as another, provided the place is always the same.

Landing should be the only "arm-and-away" service. It alone, as far as I know, with one exception, has been employed by our vessels in the last eighteen months. It is not probable nowadays that the necessity would arise for distant service, and only the most critical situation would justify a commanding officer in hazarding his men and boats from under the protection of his own guns. Such an expedition would be apt to come to grief.

For landing, besides the crew, only sitters (sharpshooters is a more appropriate technical term) will be required, each man in the boat to carry one day's rations. If it should happen that a prolonged stay in the boats or on shore, where rations are not procurable, is demanded, special arrangements could easily be made on the plan now adopted for distant service without encumbering the boat bill with its details, or confusing the men by a list of articles to provide, different for each service, and which neither they nor the officers remember.

The crew for "abandon" ship should be the same as that for arm and away, with the additional extra men. As to "abandon ship," what is urgently needed is more boats and *lighter* boats. It is probable that not a ship in the service can safely carry the crew in her own boats.

It is folly to crowd from thirty to forty into a cutter, to say nothing of "reduced rations for one week," thus bringing down the freeboard to twelve or thirteen inches and destroying its buoyancy. The evolution as now practiced may satisfy the requirements of inspections, but as a matter of absolute utility in time of disaster at sea, it could have only one miserable ending. If, however, it has been decided that the present type of ship's boats has been unalterably fixed, then it would be wise to introduce a "Birkenhead drill," whereby, at least, some of the ship's people would have a fighting chance for their lives. . . .

As to the detail of the engineer division in the powder division, it should be fixed and permanent. The idea of a shifting detail is attractive in theory, but until an engineer's yeoman is found who never shifts numbers without informing the officer of the powder division, it cannot be said to be satisfactory in practice. It is recommended that all of the coal-passers be assigned to the powder division at general quarters, their duties in the fireroom to be performed by the second-class firemen. This would, of course, reduce the number of "stand-by" stations and would conduce to more efficient service in the fireroom.

This scheme, suggested by Lieutenant S. H. May, U. S. Navy, was tried successfully on the U. S. S. Baltimore during her first commission. . . . It is stated that such a drill was actually practiced on board the U. S. S. Franklin on her famous cruise in Europe. The late Lieutenant-Commander T. B. M. Mason, U. S. Navy, commanded one group of volunteers.

One other point—the marines. It is to be hoped that the experience of the war has definitely settled this vexing question.

Had there been even 5000 marines in transports ready to move on the 21st of April, 1898, I believe that the war, from start to finish, would have been purely a naval expedition, and much history that is now unpleasant reading would never have been written. Co-operation with the army was necessary, and the movement was attended with results that recall Mr. Roderick Random's humerous early English observation on the same subject. The proposition, however, that if marines are to remain a part of the naval establishment they must be excluded entirely from men-of-war and berthed in separate transports to accompany—and subsequently be an additional care to—the fleet was probably not made seriously.

"The Coast Signal System." See page 727.

Lieutenant R. C. Smith, U. S. N.—Lieutenant Anderson deserves the thanks of the navy for his work in connection with the Coast Signal Service, before and during the war, both in Washington and in actual district duty; and lastly for the account he has written of the system for the Institute. The only information hitherto available has been in the official reports, which have not a very wide circulation even in the navy. The paper in question does not so state, but I believe that to Lieutenant Anderson is due the credit of a number of features that became a part of the system as established. As it happened, its workings did not receive the test of war; that is, it had no occasion to report the movements of the enemy's vessels. If there were defects in the system itself, they are not at once apparent to an observer that has no personal experience in the work.

This paper and the report of the Superintendent of the Coast Signal Service in the war do not leave much doubt that the nucleus of such a service should be a permanent peace establishment. If there is any criticism I can make on the paper as it stands, it is that I do not believe it would be expedient to draw on the regular coast signal service so established for reinforcing the navy in time of war and substituting them with naval militia.

This brings up a number of militia questions. The coast signal system is a very important duty in war, and is one of the duties that have been suggested for the militia. There are one or two propositions in connection with our second line of defense, the mere statement of which seems enough to ensure their acceptance: 1st. Duties such as coast signaling, local torpedo-boat service, harbor-patrol and submarine mining (this does not yet belong to the navy) cannot be most efficiently performed except by men of *local knowledge*, trained in time of peace for these actual duties in time of war. 2d. A reserve of sailors is needed to recruit the navy in time of war. 3d. The militia, by the terms of the Constitution, can be used in only three ways: to execute the laws of the Union, to suppress insurrection, and to repel invasion. If they are wanted to serve in the navy they must leave the militia and volunteer for the navy. 4th. There is an essential difference between the local land militiaman and the local naval militiaman, apart from the element in which he serves. If the land militiaman has been properly trained as a soldier he is fit to serve anywhere as a soldier. If the naval militiaman has been properly trained in local duties connected with his own coast, and is then sent somewhere else, his local training has been wasted.

In view of these four propositions, it seems that we need a naval reserve of sailors to serve anywhere, and a local naval militia to serve only on their own coast. There is an effort now on foot to create a national naval reserve, and it merits the fullest success. The naval militia, to be of the fullest use locally in time of war, should be trained on a comprehensive plan determined by the general government. The States must do the training, as that is one of their rights under the Constitution.

Why not, to ensure all these objects, invite the militia also to enroll, say as local volunteers? There would be then a national body of naval reserves for service anywhere, and a national body of naval volunteers for service on their own coast. To obtain militiamen for these duties, it would be necessary to have an understanding with the separate States, which it is thought would not be difficult. Reserves and volunteers could then serve together in their State militia. It would not be essential to have the reserves join the militia unless they so preferred, but volunteers should all be militiamen in order to get the local training. There would be an annual drill period for both branches under United States supervision, but the individuals would then be United States reserves and volunteers, and not State militia. Thus, apparently, all ends could be subserved, and the constitutional requirements as to militia service and training would not interfere. Some of these questions were discussed more at length in a paper I wrote for the Institute a year ago, entitled "Naval Reserves and Naval Volunteers."

The application of this to the Coast Signal Service is that a peace nucleus could now be established in a few important stations. In war-time some of these men would be distributed to other stations, and full complements would be made up from members of the local naval militia whose training in peace-time had been in this direction, but who would now be serving as United States naval volunteers. Perhaps when the system had attained an efficient working order, the permanent force, who might, perhaps, belong to the national naval reserve, might be withdrawn for sea service; but this would hardly be advisable for the first few months of the war.

Captain C. F. Goodrich, U. S. N.—There is little to be said on the subject of this paper. Lieutenant Anderson describes a scheme which worked well in all respects. It was put into operation with extraordinary rapidity and maintained efficiently and economically. If another foreign war breaks out, we shall only need to do again what we have already done. Personally, I am glad to have been identified with the Coast Signal Service, if for but a brief period, and to have met the many agreeable men and earnest laborers who made it a success from the start. Lieutenant Anderson is very modest withal. He totally fails to tell us how much of that success is due to his individual efforts.

Lieutenant-Commander J. B. Murdock, U. S. N.—The consideration of the yearly problems at the Naval War College has shown most forcibly the necessity of the establishment of some system of coast signal service, in order that the commanders of our fleets in time of war may be advised in good season of any hostile naval force near the coast. The solution of the various problems since 1894 has always included the development of the coast signal service for the region under consideration, and these partial solutions, formed, when united, the foundation of a service covering the whole extent of the Atlantic coast. Previous to the war with Spain it had been pointed out that the naval militia of the various States were well fitted to man and operate stations of this kind, and in 1897 orders were issued by the Navy Department by which certain officers were assigned to the instruction of the various militia organizations in the matter of off-shore signaling, so that, when hostilities began, and the signal service was actually established, very much of the preparatory work had already been considered, and the speedy development and marked efficiency of the service were the natural result.

The actual work of the signal service during the war was limited, as Mr. Anderson states in his article, by the fact that at no time did any hostile vessel appear off our coast. Its capabilities and its efficiency were, however, made manifest, and the absolute necessity of a similar service was made self-evident in case the United States should ever become involved in hostilities with any country having an aggressive naval force. It seems, therefore, that the recommendations of the writer towards the permanent establishment of signal stations at certain points, and the continued training of the State Naval Militia organizations in the operation of these stations, are both matters of the greatest importance. Whatever is to be done in time of war must be prepared for at leisure and carefully in time of peace; as, although stations may be rapidly equipped, the services of trained men cannot be obtained instantaneously.

The development of wireless telegraphy gives the Coast Signal Service a possible efficiency such as it heretofore could not possess. Flags, shapes and Ardois signals are all rendered unnecessary, and all superseded by a vastly more efficient instrument, which is capable also of transmitting information much more rapidly and over very much greater distances. The experiments made on the New York and the Massachusetts have shown that this system of telegraphy is especially adapted for use afloat; and vessels fifty miles off shore can maintain constant and perfect communication with signal stations on the coast. The cost of installation of the apparatus is probably not excessive, the special training is not arduous; but the probable developments and improvements which will take place within the next few years demand constant and unremitting attention on the part of those who may be detailed to use it. If, therefore, any system is to be adopted, or even the skeleton of a coast signal service kept in existence, officers and men should have constant practice in order to keep familiar with the latest improvements in this work. If each State militia could have two shore stations, each equipped with complete apparatus for wireless telegraphy, the men could be drilled at such seasons as might be most convenient, telegraphing from one to the other, and kept posted in all the advancements and improvements in apparatus, so that, when an emergency arose, a skilled force would already be in existence. Nothing would remain but the equipment and manning of the stations. This could be accomplished very rapidly, and a few days would suffice to equip the whole length of our coast. Without this training in time of peace the establishment of an efficient service would be a tedious service.

It may not be unwise to keep at the stations semaphores for the purpose of communicating with vessels not fitted with telegraph apparatus. In the same way flags and Very lights may be supplied, it being the function of a station to gather information in all possible ways.

If the Government is ever to have, in time of war, a uniform and thoroughly organized coast signal service, its use would mainly be in the transmission of information to or from naval vessels. It should, therefore, be under the control of the Navy Department, and, in time of peace, should be placed under one of the bureaus, which would be charged with the instruction of the various militia organizations, and the formation of plans for the enlargement, development and speedy mobilization of the signal corps in time of war. The war with Spain showed how readily the naval militia could be used for this purpose, how efficient a personnel they would make, and the detail for this duty might greatly improve the morale of the organizations by assigning them to definite responsible duties in time of war, and possibly relieve them of any ambition to perform other duties for which they are less well fitted.

PROFESSIONAL NOTES.

THE BRITISH ASSOCIATION; MECHANICAL SCIENCE SECTION.

ADDRESS OF THE PRESIDENT,*
SIR WILLIAM WHITE, K. C. B., Sc. D., LL. D., F. R. S.

ADVANTAGES OF INCREASED DIMENSIONS.

Before passing on, it may be interesting to illustrate the gain in economy of propulsion resulting from increase in dimensions by means of the following table, which gives particulars of a number of typical cruisers, all of comparatively recent design.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Length.........................ft.	280	300	360	435	500
Breadth......................... "	35	43	60	69	71
Mean draught .... "	13	16½	23¾	24½	26¼
Displacement ....tons.	1,800	3,400	7,400	11,000	14,200
Indicated horse-power for 20 knots.	6,000	9,000	11,000	14,000	15,500
Indicated horse-power per ton of displacement......................	3.3	2.65	1.48	1.27	1.09

The figures given are the results of actual trials, and embody, therefore, the efficiencies of propelling machinery, propellers, and forms of the individual ships. Even so, they are instructive. Comparing the first and last, for example, it will be seen that while the displacement is increased nearly eightfold, the power for 20 knots is only increased about 2.6 times. If the same types of engines and boilers had been adopted in these two vessels—which was not the case, of course—the weights of propelling apparatus and coal for a given distance would have been proportional to the respective powers; that is to say, the larger vessel would have been equipped with only 2.6 times the weight carried by the smaller. On the other hand, roughly speaking, the disposable weights after providing for hulls and fittings in these two vessels might be considered to be proportional to their displacements. As a matter of fact, this assumption is distinctly in favor of the smaller ship. Adopting it, the larger vessel would have about eight times the disposable weight of the smaller; while the demand for propelling apparatus and fuel would be only 2.6 times that of the smaller vessel. There will, therefore, be an enormous margin of carrying power in comparison with displacement in the larger vessel. This might be devoted—and in fact was devoted—partly to the attainment of a speed considerably exceeding 20 knots (which was a maximum for the smaller vessel), partly to increased coal endurance, and partly to protection and armament.

Another interesting comparison may be made between vessels Nos. 4 and 5 in the preceding table, by tracing the growth in power necessary to drive the vessels at speeds ranging from 10 knots up to 22 knots.

* Delivered before Section G, Dover Meeting.

	No. 4. H.-P.	No. 5. H.-P.
10 knots	1,500	1,800
12 "	2,500	3,100
14 "	4,000	5,000
16 "	6,000	7,500
18 "	9,000	11,000
20 "	14,000	15,500
22 "	23,000	23,000

It will be noted that up to the speed of 16 knots there is a fairly constant ratio between the powers required to drive the two ships. As the speeds are increased, the larger ship gains, and at 22 knots the same power is required in both ships. The smaller vessel, as a matter of fact, was designed for a maximum speed of 20½ knots, and the larger for 22 knots. Unless other qualities had been sacrificed, neither space nor weight could have been found in the smaller vessel for machinery and coals corresponding to 22 knots. The figures are interesting, however, as illustrations of the principle that economy of propulsion is favored by increase in dimensions as speeds are raised.

Going a step further, it may be assumed that in unsheathed cruisers of this class about 40 per cent. of the displacement will be required for the hull and fittings, so that the balance, or "disposable weight," would be about 60 per cent.; say 6600 tons for the smaller vessel and 8500 tons for the larger, a gain of nearly 2000 tons for the latter. If the speed of 22 knots were secured in both ships, with machinery and boilers of the same type, the larger ship would, therefore, have about 2000 tons greater weight available for coals, armament, armor and equipment.

These illustrations of well-known principles have been given simply for the assistance of those not familiar with the subject, and they need not be carried further. More general treatment of the subject, based on experimental and theoretical investigation will be found in text-books of naval architecture, but would be out of place in this address.

Swift Torpedo Vessels.

Torpedo flotillas are comparatively recent additions to war fleets. The first torpedo-boat was built by Mr. Thornycroft for the Norwegian Navy in 1873, and the same gentleman built the first torpedo-boat for the Royal Navy in 1877. The construction of the larger class known as "torpedo-boat destroyers," dates from 1893. These various classes furnish some of the most notable examples extant of the attainment of extraordinarily high speeds, for short periods and in smooth water, by vessels of small dimensions. Their qualities and performances, therefore, merit examination.

Mr. Thornycroft may justly be considered the pioneer in this class of work. Greatly impressed by the combination of lightness and power embodied in railway locomotives, Mr. Thornycroft applied similar principles to the propulsion of small boats, and obtained remarkably high speeds. His work became more widely known when the results were published of a series of trials, conducted in 1872 by Sir Frederick Bramwell, on a small vessel named the Miranda. She was only 45 feet long, and weighed 4 tons, yet she exceeded 16 knots on trial. The Norwegian torpedo-boat, built in 1873, was 57 feet long, 7½ tons, and of 15 knots; the first English torpedo-boat of 1877 was 81 feet long, 29 tons, and attained 18½ knots.

Mr. Yarrow also undertook the construction of small swift vessels at a very early date, and has greatly distinguished himself throughout the development of the torpedo flotilla. Messrs. White, of Cowes, previously well known as builders of steamboats for use on board ships, extended their operations to the construction of torpedo-boats. These three firms for a considerable time practically monopolized this special class of work in this country. Abroad, they had able competitors in Normand in France, Schichau in Germany, and Herreshoff in the United States. Keen competition led to successive improvements and rapid rise in speed. During the last six years the demand for a fleet of about 100 destroyers, to be built in the shortest possible time, involved the necessity for increasing the sources of supply. At the invitation of the Admiralty, a considerable number of the leading shipbuilding and engineering firms have undertaken and successfully carried through the construction of destroyers varying from 26 to 33 knots in speed, although the work was necessarily of a novel character, involving many difficulties.

As the speeds of torpedo vessels have risen, so have their dimensions increased. Within the class, the law shown to hold good in the larger vessels applies equally. In 1887 a first-class torpedo-boat was 81 feet long, under 30 tons weight, developed 400 horse-power, and steamed 18½ knots. Ten years later the corresponding class of boat was 135 feet long, 125 tons weight, developed 1500 horse-power and steamed 23 knots. In 1897 it had grown to 150 feet in length, 140 to 150 tons, 2000 horse-power and 26 knots.

Destroyers are not yet of seven years' standing, but they come under the rule. The first examples (1893) were 180 feet long, 240 tons, 4000 horse-power, and 26 to 27 knots. They were followed by 30-knot vessels, 200 to 210 feet long, 280 to 300 tons, 5500 to 6000 horse-power. Vessels now in construction are to attain 32 to 33 knots, their length being about 230 feet, displacements 360 to 380 tons, and engine power 8000 to 10,000 horse-power.

Cost has gone up with size and power, and the limit of progress in this direction will probably be fixed by financial considerations, rather than by constructive difficulties, great as these become as speeds rise.

It may be interesting to summarize the distinctive features of torpedo-vessel design.

1. The propelling apparatus is excessively light in proportion to the maximum power developed. Water-tube boilers are now universally adopted, and on speed trials they are "forced" to a considerable extent. High steam-pressures are used. The engines are run at a high rate of revolution—often at 400 revolutions per minute. Great care is taken in every detail to economize weight. Speed trials at maximum power only extend over three hours. On such trials in a destroyer each ton weight of propelling apparatus produces about 45 indicated horse-power. Some idea of the relative lightness of the destroyer's machinery and boilers will be obtained when it is stated that in a large modern cruiser, with water-tube boilers, high steam-pressure, and quick-running engines, the maximum power obtained on an eight hours' trial corresponds to about 12 indicated horse-power per ton of engines, boilers, &c. That is to say, the proportion of power to weight of propelling apparatus is from three and a half to four times as great in the destroyer as it is in the cruiser.

2. A very large percentage of the total weight (or displacement) of a torpedo vessel is assigned to propelling apparatus. In a destroyer of 30 knots trial speed, nearly one-half the total weight is devoted to machinery, boilers, &c. In the swiftest cruisers of large size, the corresponding

allocation of weight is less than 20 per cent. of the displacement; in the largest and fastest mail steamers it is about 20 to 25 per cent.

3. The torpedo vessel carries a relatively small load of fuel, equipment, &c. Taking a 30-knot destroyer, for example, the speed trials are made with a load not exceeding 12 to 14 per cent. of the displacement. In a swift cruiser the corresponding load would be free from 40 to 45 per cent., or proportionately more than three times as great. What this difference means may be illustrated by two statements. If, in the destroyer, the load were trebled and the vessel correspondingly increased in draught and weight, the speed attained with the same maximum power would be about 3 knots less. If, on the other hand, the vessel were designed to attain 30 knots on trial with the heavier load, her displacement would probably be increased about 70 to 80 per cent.

4. The hull and fittings of the torpedo vessel are exceedingly light in relation to the dimensions and engine power. For many parts of the structure, steel of high tensile strength is used. Throughout, the utmost care is taken to economize weight. In small vessels, for special service, many conditions can be accepted which would be inadmissible in larger sea-going vessels. The result of all this care is the production of hull-structures having ample general strength but very little local strength.

These conditions are essential to the attainment of very high speeds for short periods. They resemble the conditions ruling the design of cross-Channel steamers, so far as relative lightness of propelling apparatus, small load, and light scantlings are concerned. The essential differences lie in the requirements for passenger accommodation, as compared with the requirements for armament of the torpedo vessel. No one has yet proposed to extend the torpedo-vessel system to sea-going ships of large dimensions. Very similar conditions for the propelling apparatus have been accepted in a few cruisers of considerable dimensions, wherein high speeds for short periods were required. It is, however, unquestionable, that in many ways, and particularly in regard to machinery design, the construction of torpedo vessels has greatly influenced that of larger ships.

One important consideration must not be overlooked. For short-distance steaming, at high speeds, economy in coal consumption is of little practical importance, and it is all-important to secure lightness of propelling apparatus in relation to power. For long-distance steaming, on the contrary, economy in coal consumption is of primary importance; and savings in weight of propelling apparatus, even of considerable amount, may be undesirable if they involve increased coal consumption. Differences of opinion prevail as to the real economy of fuel obtainable with boilers and engines such as are fitted in torpedo vessels. Claims are made for some vessels which represent remarkable economy. Only enlarged experience can settle these questions.

Endurance is also an important quality in sea-going ships of large size, not merely in structures but in propelling apparatus. The extreme lightness essential in torpedo vessels obviously does not favor endurance if high powers are frequently or continuously required. Still, it cannot be denied that the results obtained in torpedo vessels show such a wide departure from those usual in sea-going ships, as to suggest the possibility of some intermediate type of propelling apparatus, applicable to large sea-going ships, and securing sufficient durability and economy of fuel in association with further savings of weight.

The Parsons Turbo-Motor.

The steam turbo-motor introduced by Mr. Charles Parsons is to be described by the inventor during these meetings; but it is impossible for me to pass it over in this review without a brief notice. This rotary engine with its very high rate of revolution, reduces the weights of machinery, shafting and propellers greatly below the weight required in the quickest-running engines of the reciprocating type. This reduction in the proportion of weight to power carries with it, of course, the possibility of higher speed in a vessel of given dimensions; and when large powers are employed the absolute gain is very great. An illustration of this has been given by Mr. Parsons, in the Turbinia. That remarkable vessel is 100 feet long, and of 44½ tons displacement, but she has attained 33 to 34 knots in short runs. There are three shafts, each carrying three screw propellers, each shaft driven by a steam turbine making over 2000 revolutions at full speed, when more than 2000 horse-power is developed. A water-tube boiler of special design supplies steam of 175 pounds pressure, and is exceptionally light for the steam produced, being highly forced. The whole weight of machinery and boilers is 22 tons: in other words, about 100 horse-power (indicated) is produced for each ton weight of propelling apparatus. This is rather more than twice the proportion of power to weight as compared with the lightest machinery and boilers fitted in torpedo-boats and destroyers. It will be noted that in the Turbinia, as in the destroyers, about half the total weight is devoted to propelling apparatus, and in both instances the load carried is relatively small. The secret of the extraordinary speed is to be found in the extreme lightness of propelling apparatus and small load.

Two other vessels of the destroyer type with turbo-motors (one for the Royal Navy) are now approaching completion. Their trials will be of great interest, as they will furnish a direct comparison with vessels of similar size and form, fitted with similar boilers but driven by reciprocating engines.

No doubt in the Turbinia lightness has been pushed further than it would be in vessels of larger size and greater power. In such vessels a lower rate of revolution would probably be accepted, additional motors would be fitted for manœuvring and going astern, boilers of relatively greater weight would be adopted, and other changes made. But after making ample allowance for all such increases in weight, it is unquestionable that considerable economies must be possible with rotary engines.

On the side of coal consumption, Mr. Parsons claims at least equality with the best triple-expansion engines. Into the other advantages attending the use of rotary engines it is not necessary now to enter.

Reference must be made, however, to one matter in which Mr. Parsons has done valuable and original work. In torpedo vessels of high speed, the choice of the most efficient propellers has always been a matter of difficulty, and the solution of the problem has in many instances involved extensive experimental trials. By means of alterations in propellers alone very large increases in speed have been effected; and even now there are difficulties to be faced. When Mr. Parsons adopted the extraordinary speed of revolution just named for the Turbinia, he went far beyond all experience and precedent, and had to face unknown conditions. He has found the solution, after much patient and original investigation, in the use of the multiple screws of small diameter. His results in this direction are of general interest to all who have to deal with screw propulsion.

Such radical changes in propelling machinery as are involved in the adoption of turbo-motors, must necessarily be subjected to thorough tests before they will be widely adopted. The experiment which the Admiralty are making is not on a small scale as regards power. Although it is made in a destroyer, about 10,000 horse-power will probably be developed, and a correspondingly high speed attained. It may well happen that from this experiment very far-reaching effects may follow. Mr. Parsons himself has prepared many designs illustrating various applications of the system to sea-going, cross-Channel, and special service vessels. Where shallowness of draught is unavoidable, the small diameter of the screws possible with the quick-running turbines is clearly an important matter.

Comparisons between Large and Small Vessels.

It has been shown that the attainment of very high speeds by vessels of small size involves many conditions not applicable to large sea-going steamships. But it is equally true that in many ways the trials of small swift vessels constitute model-experiments from which interesting information may be obtained as to what would be involved in driving ships of large size at speeds much exceeding any of which we have experience. When the progressive steam trials of such small vessels can be studied, side by side with experiments made on models to determine their resistance at various speeds, then the fullest information is obtained, and the best guide to progress secured. This advantage, as has been said, we owe to William Froude.

His contributions to the Reports of the British Associations are classics in the literature of the resistance and propulsion of ships. In 1874 he practically exhausted the subject of frictional resistance so far as it is known; and his Presidential Address to this Section in 1875 dealt fully and lucidly with the modern or stream-line theory of resistance. No doubt there would be advantage in extending Froude's experiments on frictional resistance to greater lengths and to ship-shaped forms. It is probable, also, that dynamometric determinations of the resistance experienced by ships of modern forms and considerable size, when towed at various speeds, would be of value, if they could be conducted. These extensions of what Froude accomplished are not easily carried out; and in this country the pressure of work on shipbuilding for the Royal Navy has, for many years past, taxed to the utmost limits the capacity of the Admiralty experimental establishment, so ably superintended by Mr. R. E. Froude, allowing little scope for purely scientific investigations, and making it difficult to deal with the numerous experiments incidental to the designs of actual ships. Now that Holland, Russia, Italy and the United States have equipped experimental establishments, while Germany and France are taking steps in that direction, we may hope for extensions of purely scientific work and additions to our knowledge. In this direction, however, I am bound to say that much might be done if experimental establishments, capable of dealing with questions of general nature relating to resistance and propulsion, were added to the equipment of some of our universities and colleges. Engineering laboratories have been multiplied, but there is as yet no example of a model experimental tank, devoted to instruction and research.

It is impossible, and possibly is unnecessary, to attempt in this address any account of Froude's "scale of comparison" between ships and models at "corresponding speeds." But it may be of interest to give a few illustrations of the working of this method, in the form of a contrast between a destroyer of 300 tons, 212 feet long, capable of steaming 30 knots, and a vessel of similar form enlarged to 765 feet in length and 14,100 tons. The ratio of dimensions is here about 3.61:1; the ratio of displacements is 47:1; and the ratio of corresponding speeds is 1.9:1.

To 12 knots in the small vessel would correspond 22.8 knots in the large vessel; and the resistance experienced by the large vessel at 22.8 knots (neglecting a correction for friction) should be 47 times that of the small vessel at 12 knots. By experiment this resistance for the small vessel was found to be 1.8 tons. Hence for the large vessel at 22.8 knots the resistance should be 84.6 tons. This would correspond to an "effective horse-power" of over 13,000, or to about 26,000 indicated horse-power. The frictional correction would reduce this to about 25,000 horse-power, or about 1.8 horse-power per ton. Now, turning to the destroyer, it is found experimentally that at 22.8 knots she experiences a resistance of 11 tons, corresponding to an effective horse-power of over 1700 horse-power, and an indicated horse-power of about 3000 horse-power: say 10 horse-power per ton, or nearly 5½ times the power per ton required in the larger vessel. This illustrates the economy of propulsion arising from increased dimensions.

Applying the same process to a speed of 30 knots in the large ship, the corresponding speed in the small ship is 15.8 knots. Her resistance at that speed is experimentally determined to be 3.5 tons, and the resistance of the large ship at 30 knots (neglecting frictional correction) is about 165 tons. The effective horse-power of the large ship at 30 knots is, therefore, about 34,000, corresponding to 68,000 horse-power indicated. Allowing for the frictional correction, this would drop to about 62,000 horse-power, or 4.4 horse-power per ton. For the destroyer at 30 knots the resistance is about 17½ tons; the effective horse-power is 3600, and the indicated horse-power about 6000, or 20 horse-power per ton, nearly five times as great as the corresponding power for the large ship. But while the destroyer under her trial conditions actually reaches 30 knots, it is certain that in the large ship neither weight nor space could be found for machinery and boilers of the power required for 30 knots, and of the types usually adopted in large cruisers, in association with an adequate supply of fuel. The explanation of the methods by which the high speed is reached in the destroyer has already been given. Her propelling apparatus is about one-fourth as heavy in relation to its maximum power, and her load is only about one-third as great in relation to the displacement, when compared with the corresponding features in the cruiser.

The earlier theories of resistance assumed that the resistance experienced by ships varied as the square of the speed. We now know that the frictional resistances of clean-painted surfaces of considerable length vary as the 1.83 power of the speed. This seems a small difference, but it is sensible in its effects, causing a reduction of 32 per cent. at 10 knots. On the other hand, it is now known that the laws of variation of the residual or wave-making resistance may depart very widely from the law of the square of the speed, and it may be interesting to trace for the typical destroyers how the resistance actually varies.

Take first the total resistance. Up to 11 knots it varies nearly as the square of the speed: at 16 knots it has reached the cube: from 18 to 20 knots it varies as the 3.3 power. Then the index begins to diminish: at

22 knots it is 2.7: at 25 knots it has fallen to the square, and from thence to 30 knots it varies practically as does the frictional resistance.

The residual resistance varies as the square of the speed up to 11 knots, as the cube at 12½ to 13 knots, as the fourth power about 14½ knots, and at a higher rate than the fifth power at 18 knots. Then the index begins to fall, reaching the square at 24 knots, and falling still lower at higher speeds.

It will be seen, therefore, that when this small vessel has been driven up to 24 or 25 knots by a large relative expenditure of power, further increments of speed are obtained with less proportionate additions to the power.

Passing from the destroyer to the cruiser of similar form but of 14,100 tons, and once more applying the scale of comparison, it will be seen that to 25 knots in the destroyer corresponds a speed of 47½ knots in the large vessel. In other words, the cruiser would not reach the condition where further increments of speed are obtained with comparatively moderate additions of power until she exceeded 47 knots, which is an impossible speed for such a vessel under existing conditions. The highest speeds that could be reached by the cruiser, with propelling apparatus of the lightest type yet fitted in large sea-going ships, would correspond to speeds in the destroyer for which the resistance is varying as the highest power of the speed. These are suggestive facts.

Frictional resistance, as is well known, is a most important matter in all classes of ships and at all speeds. Even in the typical destroyer this is so. At 12 knots the friction with clean-painted bottom represents 80 per cent. of the total resistance; at 16 knots, 70 per cent.; at 20 knots, a little less than 50 per cent.; and at 30 knots, 45 per cent. If the coefficient of friction were doubled and the maximum power developed with equal efficiency, the loss of speed of fully 5 knots would result.

In the cruiser of similar form the friction represents 90 per cent. at 12 knots; 85 per cent. at 16 knots; nearly 80 per cent. at 20 knots; and over 70 per cent. at 23 knots. If the coefficient of friction were doubled at 23 knots, and the corresponding power developed with equal efficiency, the loss of speed would approximate to 4 knots.

These illustrations only confirm general experience, that clean bottoms are essential to economical propulsion and the maintenance of speed, and that frequent docking is necessary in vessels with bare iron or steel skins, which foul in a comparatively short time.

Possibilities of Further Increase in Speed.

From the facts above mentioned it is obvious that the increase in speed which has been effected is the result of many improvements, and has been accompanied by large additions to size, engine-power and cost. These facts do not discourage the "inventor," who finds a favorite field of operataion in schemes for attaining speeds of 50 to 60 knots at sea in vessels of moderate size. Sometimes the key to this remarkable advance is found in devices for reducing surface friction by the use of wonderful lubricants to be applied to the wetted surfaces of ships, or by interposing a layer of air between the skins of ships and the surrounding water, or other departures from ordinary practice. If these gentlemen would "condescend to figures," their estimates, or guesses, would be less sanguine. In many cases the proposals made would fail to produce any sensible reduction in resistance; in others it would increase resistance.

Other proposals rest upon the idea that resistance may be largely reduced by adopting novel forms, departing widely from ordinary ship shapes. Very often small-scale experiments, made in an unscientific and inaccurate manner, are adduced as proofs of the advantages claimed. In other instances mere assertion is thought sufficient. Ordinarily, no regard is had to other considerations, such as internal capacity, structural weight and strength, stability and seaworthiness. Most of these proposals do not merit serious consideration. Any which seem worth investigation can be dealt with simply and effectively by the method of model experiments. A striking example of this method will be found in the unusual form of a Parliamentary Paper (No. 313 of 1873), containing a report made by Mr. William Froude to the Admiralty. Those interested in the subject will find therein much matter of special interest in connection with the conditions attending abnormally high speeds. It must suffice now to say that ship-shaped forms are not likely to be superseded at present.

The most prolific "inventions" are those connected with supposed improvements in propellers. One constantly meets with schemes guaranteed by the proposers to give largely increased efficiency and corresponding additions to speed. Variations in the numbers and forms of screws or paddles, the use of jets of water or air expelled by special apparatus through suitable openings, the employment of explosives, imitations of the fins of fishes, and numberless other departures from established practice are constantly being proposed. As a rule, the "inventors" have no intimate knowledge of the subject they treat, which is confessedly one of great difficulty. When experiments are adduced in support of proposals, they are almost always found to be inconclusive and inaccurate. More or less mathematical demonstrations find favor with other inventors, but they are not more satisfactory than the experiments. An air of great precision commonly pervades the statements made as to possible increase in efficiency or speed. I have known cases where probable speeds with novel propellers have been estimated (or guessed) to the third place of decimals. In one such instance a trial was made with the new propeller, with the result that instead of a gain in efficiency there was a serious loss of speed. Very few of the proposals made have merit enough to be subjected to trial. None of them can possibly give the benefits claimed.

It need hardly be added that in speaking thus of so-called "inventors," there is no suggestion that improvement has reached its limit, or that further discovery is not to be made. On the contrary, in regard to the forms of ships and propellers, continuous investigation is proceeding and successive advances are being made. From the nature of the case, however, the difficulties to be surmounted increase as speeds rise; and a thorough mastery of the past history and present conditions of the problems of steamship design and propulsion is required, as a preparation for fruitful work in the nature of further advance.

It would be idle to attempt any prediction as to the characteristic features of ocean navigation sixty years hence. Radical changes may well be made within that period. Confining attention to the immediate future, it seems probable that the lines of advance which I have endeavored to indicate will remain in use. Further reductions may be anticipated in the weight of propelling apparatus and fuel in proportion to the power developed; further savings in the weight of the hulls, arising from use of stronger materials and improved structural arrangements; improvements in form; and enlargements in dimensions. If greater draughts of water can be made possible, so much the better for carrying power and speed. For merchant vessels, commercial considerations must govern the final decision; for warships the needs of naval warfare will prevail. It is certain that scientific methods of procedure, and the use of model experiments on ships and propellers, will become of increased importance.

Already avenues for further progress are being opened. For example, the use of water-tube boilers in recent cruisers and battleships of the Royal Navy has resulted in saving one-third of the weight necessary with cylindrical boilers of the ordinary type to obtain the same power, with natural draught in the stokeholes. Differences of opinion prevail, no doubt, as to the policy of adopting particular types of water-tube boilers; but the weight of opinion is distinctly in favor of some type of water-tube boiler in association with the high steam-pressures now in use. Greater safety, quicker steam raising, and other advantages, as well as economy of weight can thus be secured. Some types of water-tube boilers would give greater saving in weight than the particular type used in the foregoing comparison with cylindrical boilers.

Differences of opinion prevail also as to the upper limit of steam pressure which can with advantage be used, taking into account all the conditions in both engines and boilers. From the nature of the case, increases in pressure beyond the 160 lbs. to 180 lbs. per square inch commonly reached with cylindrical boilers, cannot have anything like the same effect upon economy of fuel as the corresponding increases have had, starting from a lower pressure. Some authorities do not favor any excess above 250 lbs. per square inch on the boilers; others would go as high as 300 lbs., and some still higher.

Passing to the engine-rooms, the use of higher steam pressures and greater rates of revolution may, and probably will, produce reductions in weight compared with power. The use of stronger materials, improved designs, better balance of the moving parts, and close attention to details, have tended in the same direction without sacrifice of strength. Necessarily, there must be a sufficient margin to secure both strength and endurance in the motive power of steamships. Existing arrangements are the outgrowth of large experience, and new departures must be carefully scrutinized.

The use of rotary engines, of which Mr. Parsons' turbo-motor is the leading example at present, gives the prospect of still further economies of weight. Mr. Parsons is disposed to think that he could about halve the weights now required for the engines, shafting, and propellers of an Atlantic liner while securing proper strength and durability. If this could be done in association with the use of water-tube boilers, it would effect a revolution in the design of this class of vessel, permitting higher speeds to be reached without exceeding the dimensions of existing ships.

It does not appear probable that with coal as fuel, water-tube boilers will surpass in economy the cylindrical boilers now in use; and skilled stoking seems essential if water-tube boilers are to be equal to the other type in rate of coal consumption. The general principle holds good that, as more perfect mechanical appliances are introduced, so more skilled and disciplined management is required in order that the full benefits may be obtained. In all steamship performances the "human factor" is of great importance, but its importance increases as the appliances become more complex. In engine-rooms the fact has been recognized and the want met. There is no reason why it should not be similarly dealt with in the boiler-rooms.

Liquid fuel is already substituted for coal in many steamships. When sufficient quantities can be obtained it has many obvious advantages over coal, reducing greatly manual labor in embarking supplies, conveying it to the boilers, and using it as fuel. Possibly its advocates have claimed for it greater economical advantages over coal than can be supported by the results of extended experiment. Even if the saving in weight for equal evaporation is put as low as 30 per cent. of the corresponding weight of coal, it would amount to 1000 tons on a first-class Atlantic liner. This saving might be utilized in greater power and higher speed, or in increased load. There would be a substantial saving on the stoke-hole staff. At present it does not appear that adequate supplies of liquid fuel are available. Competent authorities, here and abroad, are giving attention to this question, and to the development of supplies. If the want can be met at prices justifying the use of liquid fuel there will undoubtedly be a movement in that direction.

Stronger materials for the construction of hulls are already available. They are, however, as yet but little used except for special classes of vessels. Mild steel has taken the place of iron, and effected considerable savings of weight. Alloys of steel with nickel and other metals are now made which give strength and rigidity much superior to mild steel, in association with ample ductility. For destroyers and torpedo-boats this stronger material is now largely used. It has also been adopted for certain important parts of the structures of recent ships in the Royal Navy. Of course the stronger material is more costly, but its use enables sensible economies of weight to be made It has been estimated, for example, that in an Atlantic liner of 20 knots' average speed, about 1000 tons could be saved by using nickel steel instead of mild steel. This saving would suffice to raise the average speed more than a knot, without varying the dimensions of the ship.

Alloys of aluminium have also been used for the hulls or portions of the hulls of yachts, torpedo-boats, and small vessels. Considerable savings in weight have thus been effected. On the other hand, these alloys have been seriously corroded when exposed to the action of sea water, and on that account are not likely to be extensively used. Other alloys will probably be found which will be free from this defect, and yet unite lightness with strength to a remarkable degree.

Other examples might be given of the fact that the metallurgist has by no means exhausted his resources, and that the shipbuilder may look to him for continued help in the struggle to reduce the weights of floating structures.

It is unnecessary to amplify what has already been said as to possible increase in the efficiency and types of propellers. With limited draught, as speeds increase and greater powers have to be utilized, multiple propellers will probably come into use. Mr. Parsons has shown how such problems may be dealt with; and other investigators have done valuable work in the same direction.

In view of what has happened, and is still happening, it is practically certain that the dimensions of steamships have not yet attained a maximum.

Thanks to mechanical appliances, the largest ships built, or to be built, can be readily steered and worked. In this particular, difficulties have diminished in recent years, notwithstanding the great growth in dimensions.

Increase in length and weight favor the better maintenance of speed at sea. The tendency, therefore, will be to even greater regularity of service than at present. Quicker passages will, to some extent, diminish risks, and the chance of breakdown will be lessened if multiple propellers are used. Even now, with twin-screws, the risk of total breakdown is extremely small.

Whatever may be the size and power of steamships, there must come times at sea when they must slow down and wait for better weather. But the larger and longer the vessels, the fewer will be the occasions when this precaution need be exercised.

It must never be forgotten, that as ships grow in size, speed and cost, so the responsibilities of those in charge increase. The captain of a modern steamship needs remarkable qualities to perform his multifarious duties efficiently. The chief engineer must have great powers of organization, as well as good technical knowledge to control and utilize most advantageously the men and machinery in his charge. Apart from the ceaseless care, watchfulness and skill of officers and men, the finest ships and most perfect machinery are of little avail. The "human factor" is often forgotten, but is all-important. Let us hope that in the future, as in the past, as responsibilities increase, so will the men be found to bear them.—*Engineering.*

DESIGNS FOR THE DENVER CLASS, SHEATHED PROTECTED CRUISERS.

By Chief Constructor PHILIP HICHBORN, U. S. N., Vice-President.*

Having been invited to contribute the usual paper covering designs prepared during the past year, I take pleasure in laying before the society a brief description of the sheathed protected cruisers provided for in the last appropriations for increase of the navy, together with the general plans, a statement of the general characteristics, weights, etc.

The act of Congress approved March 3, 1899, provided for three sheathed sea-going battleships of about 13,500 tons trial displacement, at a cost for hull and machinery not to exceed $3,600,000 each; for three sheathed armored cruisers of about 12,000 tons trial displacement, at a cost for hull and machinery not to exceed $4,000,000 each; and for "six protected cruisers of about 5500 tons trial displacement, to be sheathed and coppered, and to have the highest speed compatible with good cruising qualities, great radius of action, and to carry the most powerful ordnance suited to vessels of their class, and to cost, exclusive of armament, not exceeding $1,141,800 each."

The act further provided that "in no case shall a contract be made for the construction of the hull of any vessel authorized by this act until a contract has been made for the armor of such vessel." The limiting price for the armor of these vessels was fixed by the same act at $300 per ton, and the effort to make contracts within this limit was unsuccessful. The designs for the battleships and armored cruisers have proceeded

* Read at the seventh general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 16 and 17, 1899.

slowly on this account, and will not be submitted for the Navy Department's action for some time to come. I am unable, therefore, to present these designs for this year's proceedings.

The question of armor not being involved in the case of the smaller cruisers, the designs for these vessels were completed and bids invited for their construction under the usual conditions, allowing bidders to submit proposals on the plans and specifications issued by the department, or on their own plans and specifications, based upon certain requirements outlined in the department's circular issued about August 1 for the information of shipbuilders. At the time of preparing this paper, plans and specifications are being sent out to such responsible bidders as have requested them—November 1 having been set as the date for opening bids.

The chief characteristics of the design for these cruisers were settled and approved by the department before the final preparation of the general plans. These characteristics show the vessels to be about the size of the Raleigh and Cincinnati, which, though classed as 19-knot vessels, with more than double the horse-power of the present designs, have never been able, owing to certain well-known conditions, to maintain a speed even approximating to the rated 19 knots for any length of time. The Raleigh, when with Dewey's squadron, was only able to steam, with difficulty, at a speed of 9 knots, using three-fifths of the boiler power. The coal supply of these vessels was also limited, and the coal consumption was a serious question when making passage between distant ports.

In the new designs a liberal allowance has been assigned to all the principal weights, and there has been no attempt to secure "fancy" results either on paper or on trial. They have been designed for hard service, and the offensive and defensive properties, suitable speed, durability, habitability, etc., were carefully considered in determining their characteristics. Owing to the nature of the service which they were likely to perform, independence of coaling and repair stations, as far as possible, was believed to be an important consideration.

In view of the fact that the vessels were to be sheathed and coppered, and that the machinery was to be liberally proportioned, a speed of 16½ knots, as representing the capacity of the vessel at all times, was considered sufficient, and easily places the ships in the class with our earlier vessels making 19 or 20 knots on a forced trial with clean bottoms.

The coal supply is represented by a bunker capacity of 700 tons: sufficient to give them a radius of action at full speed of nearly 2500 knots, and at the most economical rate of steaming—probably in the neighborhood of 10 knots per hour—they will be able to steam about 7000 knots without recoaling. This would cover a continuous trip from San Francisco to Manila.

Careful consideration has been given to the strength of the vessels, and the scantlings are unusually heavy. The frames are spaced 36 inches throughout the length of the vessel. The inner bottom will be 204 feet in length, divided into 29 compartments. Between the inner bottom and the protective deck there will be 67 water-tight compartments, and above the protective deck, 39, making a total of 135 compartments in the vessel. They will have three complete steel decks. There will be three longitudinals on each side of the water-tight 34-inch vertical keel, in addition to the bilge stringer and side stringer. The protective deck will be water-tight and ½ inch in thickness throughout. In addition there will be 2 inches of nickel steel 8 feet in width on each slope, for a length of 105 feet in the wake of the machinery. Forward and abaft this on the slope the ½-inch plating will be doubled.

The ram bow has been entirely omitted, it being considered unnecessary for this class of vessel.

Being sheathed, the stem, stern-posts, shaft-struts and rudder will be of manganese bronze.

The wood sheathing will be of Georgia pine, fitted in a single thickness of 4 inches, secured by composition bolts tapped through the plating, and with nut and washer on the inside. The copper sheathing will be of 28- to 32-ounce material.

Over the protective deck and along the water-line a coffer-dam 27 inches in width and about 4 feet in depth will be fitted; the top of the coffer-dam being about 2½ feet above the normal or 15-foot 9-inch water-line. Fire-proofed corn-pith cellulose will be used as obturating material. This will be packed to a density of 8 pounds per cubic foot, the total capacity of the coffer-dam at this rate being about 24 tons.

The main deck will be the only one planked with wood, and this wood, together with all other wood used in the construction of the vessel, except outside sheathing and that used for special purposes, such as electric-wire mouldings, will be treated with an approved fire-proofing process before being worked into the ship. Careful attention has been given to reducing the amount of woodwork in the ship to the minimum. Stateroom bulkheads and the like will be of corrugated metal.

As previously stated, a liberal allowance has been made for machinery weights, the engine-room weights per indicated horse-power being about 10 per cent. heavier than is the case with the Raleigh or Detroit classes. The total machinery weight is somewhat reduced, proportionately, by the use of water-tube boilers and high pressures.

The ventilation of machinery spaces will be thorough, and not subject to the criticism to which the Raleigh and Cincinnati were exposed.

The armament of each of the vessels will consist of a main battery of ten 5-inch guns of 50 calibers length, and a secondary battery of eight 6-pounders, two 1-pounders, four Colt's automatic guns, and one 3-inch field gun. Eight of the 5-inch guns will be mounted on the gun deck in recessed ports; the forward pair having a range from directly forward to 60 degrees abaft the beam, and the second pair from 83 degrees forward to 60 degrees abaft the beam, the four after guns being similarly placed as regards stern fire. The two remaining 5-inch guns will be mounted behind shields on the main deck, one forward and one aft. Four 6-pounders will be mounted on the gun deck, two forward and two about amidships, and the other four 6-pounders will be located on the main deck. The two 1-pounder guns will be mounted aft on the gun deck, and the Colt machine guns on top of the hammock berthing amidships.

The plating around the gun ports of the gun-deck battery will be thickened up with nickel steel to 1¾ inches. The shields of the 5-inch guns on the main deck will be of 2-inch nickel steel.

The ammunition supply will be unusually large, and will include 250 rounds for each of the 5-inch guns, and 500 rounds for each of the 6-pounders. The use of smokeless powder is contemplated for all ammunition, and special appliances will be fitted for keeping the temperature of the magazines to a minimum. The nature of these appliances will depend somewhat on the results of experience with the battleships now building.

Each vessel will be fitted with a distilling plant, ice-machine, refrigerating rooms, electric ammunition-hoists, winches and blowers, two searchlights, electrical signaling and other outfits. Storerooms for various purposes will be ample and commodious.

The electric generating plant will consist of 4 units, each with a rated output of 300 amperes at 80 volts.

The complete deck over the battery adds greatly to the efficiency of the design. The complement of crews assigned to each vessel is 263, including 27 marines. These can be readily accommodated. In fact, 450 men could be berthed without discomfort, and the vessels can, therefore, be used to advantage in transporting relief crews to foreign stations, or for other similar service.

Dimensions and particulars of the design, including weights and other data, including machinery, are given in an appendix to the paper, and plates are appended showing the general arrangement of the vessels.

So much has been published about the cruisers built for the Brazilian government, and purchased by us just prior to the outbreak of hostilities with Spain, that I cannot refrain from presenting a few facts—principally because the published statements have been used for the purpose of making unfavorable comparisons with our new designs. One of these publications, for instance, in a prominent scientific paper contained cuts of the vessels, with certain particulars headed, respectively, "The 3500-ton protected cruiser New Orleans" and "The proposed 3500-ton semi-protected cruiser Denver and class." It takes but a glance to discover the first gross error in this comparison, for those familiar with the facts—the New Orleans having left the New York yard a short time ago, in ordinary full-load condition, displacing over 4000 tons. Under exactly similar conditions, the Denver and class will displace only 3500 tons, and at this displacement the actual weight of ammunition carried and the actual weight of stores aboard will be greater than in the case of the New Orleans at 4000 tons. Moreover, the coal will be practically the same, for the Denver will stow and carry 700 tons readily on 3500 tons displacement, while the most that has ever been in the New Orleans bunkers, as far as is known—and certainly what was in her bunkers when displacing the 4000 tons referred to above—was less than 750 tons.

I do not pretend to criticise the design or construction of the New Orleans, but she is essentially a "show" vessel, cleverly designed to that end, but not such a design as would be found emanating from the British Admiralty or from our Navy Department. Briefly stated, she was designed purely for speed and the heaviest battery the law would allow. With her extra length of about 50 feet she will not manœuvre as well as the Denver class; with her extra draught of about 3 feet she is considerably handicapped for work in shallow harbors; with her heavy battery (of little advantage, considering the small amount of ammunition carried) she could not stand the weight of a flush upper deck, and even without it her top weights are such that, particularly without the water-line protection of cellulose provided for the Denver class, she is not nearly so well prepared to stand punishment as will be those vessels. Her powerful machinery and large battery necessitate a crew out of all proportion to the accommodations provided, and considerable objection has been filed, by those connected with the ship, in regard to the unsatisfactory provision for officers and crew, including boat capacity for very little more than half the number. Her auxiliary appliances for lighting, heating, refrigerating, etc., were, in some cases, omitted in the original design, or were meager and unsatisfactory, and have had to be added since, with increased weight.—*Scientific American Supplement.*

CAUSES FOR THE ADOPTION OF WATER-TUBE BOILERS IN THE UNITED STATES NAVY.*

By George W. Melville, Engineer-in-Chief, U. S. N., Vice-President.

It has been a number of years since I have had the honor and pleasure of addressing this society. Speaking generally, the progress and design of machinery of warships has been, during that time, along such well-developed lines, and so in accordance with the generally-accepted theories of designers, that there has been little to say. More recently, however, in order to keep pace with the times and to cope with the necessity we have always before us of securing ships that will be in nowise inferior to those built for any other nations, a change in machinery design has been made that at first glance appears radical—the general adoption of water-tube boilers for all new vessels of our navy.

Elsewhere violent diatribes have been launched against those responsible for a similar decision, and I am aware that there exists a not inconsiderable sentiment in this country against water-tube boilers. I call it a sentiment advisedly, because I believe that much of it is due to the attachment that engineers have for their old and proved friend, the cylindrical boiler.

Only a part of the opinions unfavorable to the change arises from the natural and proper conservatism of naval architects and marine engineers, but these demand answer. Flooded always with new devices, or rather by rejuvenated failures in new forms, we find a very small proportion that is even worthy of a trial, and where a new mechanical idea is tried on shipboard, so much time is spent in adapting it to naval conditions and in repairing its failures that each of us becomes naturally and properly dubious when any change is suggested. Any important change in design, even of the apparently minor fittings of ships, may involve such risk to vessel and crew as to be unjustifiable, unless the device be thoroughly tried beforehand. Many apparently good ideas have given successful results on shore only to fail dismally at sea. I think that it may be given as a general rule that no change in design should be authorized that has not already been successfully made.

Of course, a strict application of the foregoing rule would lead to stagnation. Here, however, enters the designer. His role is an important one. He has to cull the good points from previous work, and, if he be a good designer, he must also leave out the bad points. There always are some bad points, but amelioration of conditions should be the aim of naval designers. This implies that a good designer must be of vast experience and of extended observation. The larger his field of observation, the more valuable his conclusions. It is the details that count. No man can succeed as a designer of warships without the most careful attention to small things.

* Read at the seventh general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 16 and 17, 1899.

The modern battleship is a monument to the greatness of the minutiæ of design. It has been gradually built up from the sailing beauties of a century ago. Steps in advance have been slow, generally speaking. We cannot advance by leaps and bounds in marine work. Here genius is hampered by such conditions as make any step in advance a great achievement. Of course, we have the case of Ericsson and the Monitor, but this was a case not only of special conditions but also of a most exceptional man. Naval architecture is a pyramid, each stone of which is supported by all of the preceding ones. The size of the stone that one man can add to the pile depends, of course, upon his ability, but more especially upon his work. By hard work and by paying attention to what is going on around him any man can add his quota, but "those who, having eyes, see not; and who, having ears, hear not," are worse than useless.

The task I have set myself to-day is no mean one. I desire to show that the decision to use nothing but water-tube boilers in our future war vessels is a step in advance, and that it is a natural step toward the evolution of the perfect fighting machine. I desire to show that it is no radical change, and that it does not involve the use of anything but a tried, successful and reliable apparatus that gives us positive and great advantages over the character of boilers heretofore generally used. I desire not to minimize the disadvantages following this change, but to show that these disadvantages are not only not insurmountable, but, for warships, they have already been overcome.

In the first place, I want to state that water-tube boilers are bad in principle. They carry the pressure inside their weakest parts, the tubes. A failure in a tube is followed by the opening of a fault, sometimes to a dangerous degree. In a fire-tubular boiler, on the contrary, the pressure would continue to close a split tube. It is true that a failure of a boiler tube generally comes from pitting, where fire-tubular boilers generally have such a great advantage, as in cases of split tubes. Yet failure of tubes is the most common defect in all boilers, and a proper design would place the pressure on the outside of the tube. Water-tube boilers are, from their very definition, designed from a wrong principle, not only because of the direction of application of pressure upon the tubes, but also on account of the decreased amount of water in the boiler, of the increased difficulty of observing a leak, and of the decreased value of heating surface in water-tube boilers. For this reason, as an engineer, it is with some misgivings that I state that I consider water-tube boilers tactical necessities for warships.

Builders of water-tube boilers use solid-drawn tubes almost exclusively for marine work. This, of course, decreases the danger of split tubes, but it does not change the mechanical principle. Some day, probably not in my time, we may hope to have a boiler having fire tubes and having the advantages of water-tube boilers. Such a boiler would force its way at once into all navies, just as water-tube boilers are doing at the present day.

Disbelieving, as I do, in the cardinal principles of water-tube boilers, I have sturdily opposed their adoption by our navy until now I am convinced that they must be used if we are not going to content ourselves with inferior ships to those built for other nations. Of course, during the period of development of the design of water-tube boilers, that even now continues, I have, in my official capacity, kept track of and taken part in the world-wide experiments with their use. Water-tube boilers have advantages and I have never been blind to them. Two years ago I stated that their disadvantages had been sufficiently removed to justify their use on our warships. Now I consider that the value of their advantages has been sufficiently developed to necessitate their use if we do not wish to be left behind in naval design.

The principal thing to which I desire to call attention is the fact that all vessels are essentially compromises. Any ship must be considered in its entirety, and the advisability of a change in design of any part must be determined from its effect upon the ship as a whole. Whether or not water-tube boilers are superior to cylindrical boilers as boilers simply, if there be a beneficial effect upon the ship as a whole due to the adoption of water-tube boilers, these boilers are essential to the best design.

The necessity of compromise in ship design must be self-evident to the members of this society, who have the problem before them for solution almost daily. Taking the particular case of warships, the size of our ships is limited by their draught. We are building vessels now that are as large as any that can enter our harbors and docks, and we cannot, therefore, increase their power as fighting ships except by improvements in design. Any increase in weight allotted to one essential of the efficiency of the ship must be counterbalanced by a decrease in some other perhaps equally essential element. So far, this has most frequently been done by robbing the coal pile; an extra gun, a half-knot in speed, or an additional inch in armor protection—each mean a few tons less coal in the bunkers. I must except the more recent designs of battleships from the above general rules. The importance of coal endurance has become more and more manifest, and it has been appreciated fully in our recent designs. Incidentally, these last ships are fitted with water-tube boilers.

Water-tube boilers are considerably lighter than those of the old type, and their effect upon ship design may be given as follows: Of two ships having all other qualities identical, one fitted with cylindrical boilers and the other with water-tube boilers, the latter will be somewhat the smaller and handier—will have somewhat less draught, and will cost less.

Limited, as we are, in the size of our warships by their draught, I think that the foregoing shows that for a maximum of fighting efficiency we must use water-tube boilers. The designing engineers of our naval vessels are limited in weight and space. They save little or nothing in space perhaps, but they save greatly in weight if they adopt water-tube boilers. If these can be successfully operated on shipboard, they must be used because of their decreased weight. The foregoing is entirely apart from any consideration of the relative merits of water-tube and fire-tubular boilers, but it is conditional upon the possibility of the successful operation of water-tube boilers.

Before considering claimed advantages and disadvantages of water-tube boilers, I desire to give a few historical facts, most of them already well known to the members of this society.

The old Martin boiler was the first water-tube boiler ever used in any naval vessel. We had good success with these boilers, but they died out of use with the introduction of high-pressure multiple-expansion engines and the consequent cylindrical boilers.

For years none but water-tube boilers have been installed in our steam launches. These have always been attended by unskilled labor, and yet the results have been very satisfactory. Some accidents have occurred, but they have been very few, probably no greater in number than if fire-tubular boilers had been used, and it is to be noted that the results of a boiler explosion would probably have been worse in almost every case if the failure had occurred in a fire-tubular boiler.

Torpedo-boats and destroyers in our navy have always, since the time of the Cushing, been equipped with water-tube boilers of various types. Small bent-tube boilers have generally been used. There have been some cases of sad accidents in the fire-rooms, generally due to carelessness in manufacture, and particularly in tube-setting, but not to defective design. The boilers have proved to be quite as reliable as the extremely light engines of these boats. With the small amount of skilled attention it is possible to give torpedo-boats, and considering the character of service demanded of these small craft, I think that no engineer will to-day question that the use of light water-tube boilers, with the higher speeds possible as a result, adds to their efficiency and security. I think even Herr Schichau has come to be of this opinion.

The first large installation of water-tube boilers in our navy was on the Monterey. Indeed, at the time, this was the largest installation of water-tube boilers in any navy. In this monitor, as you all know, there are four round Ward water-tube boilers, with two cylindrical single-ended fire-tubular boilers. The water-tube boilers have been satisfactory. It is worthy of note that there has been very little difficulty experienced in maintaining a steady water level, although the boilers have a very small amount of contained water. Tubes have failed by pitting several times, though never with any danger to the firemen. The water-tube boilers have been twice retubed by the ship's force without laying the ship up at any navy yard. On one occasion, probably with a view to thoroughly testing the water-tube boilers, or to satisfy the unholy desires of some person decrying water-tube boilers, the ship made a voyage of about 8000 knots, largely under forced draught, and, whenever possible, with all boilers in use. There was no resultant injury to the water-tube boilers, which performed well throughout the trial. The combustion chambers of the cylindrical boilers came out of the trial badly bulged.

The Yarrow boilers of the Nashville have operated fairly successfully, though they cannot be said to be completely satisfactory on account of the amount of trouble given by bulging of drums and by leaky tubes.

The first set of copper tubes has been replaced by others of steel to considerable advantage. I believe that the latest designs of this type of boiler provide for the use of slightly curved tubes next the fire. This ought to be advantageous.

The Marietta's trip around South America at the beginning of the war with Spain, was quite as successful as was that of the Oregon. The first ship is fitted with Babcock & Wilcox boilers, the second with cylindrical boilers. No repairs were required to either set of boilers after the completion of the trip.

The Annapolis is also equipped with Babcock & Wilcox boilers, and here, as on the Marietta, these boilers have been thoroughly successful. Indeed, a former chief engineer of the Annapolis has stated to me that the boilers of that ship were easier to manage in use and easier to maintain in a state of high efficiency than are cylindrical boilers.

The Chicago has several Babcock & Wilcox boilers, and these have so far worked in a thoroughly satisfactory manner, no failure being reported under any circumstances.

The foregoing represents the tried installations of water-tube boilers in ships larger than torpedo-boats and destroyers in the United States

Navy. Babcock & Wilcox boilers of the shore or stationary type were installed in the old monitors Canonicus, Mahopac and Manhattan, the old rectangular boilers being entirely worn out and it being deemed advisable to fit these old boats for whatever service they could do. The change was commenced at the beginning of the Spanish war. Before its close the change was complete and a somewhat greater speed was attained than with the original boilers. This change was made without injuring the decks of the monitors. The old boilers were cut up and passed out through the smokestack, down which the parts of the new boilers were passed, the latter being assembled in the engine-room space. This is an instance where none but water-tube boilers could have been used, and where every facility of repair and installation was of enormous advantage. For naval vessels with their protective decks the facility with which water-tube boilers can be removed or completely renewed without disturbing the decks may, of itself, justify us in adopting water-tube boilers.

There are building and repairing several other ships of our navy to be fitted with partial or complete outfits of water-tube boilers. These include the Alert, Atlanta, Cincinnati, Wyoming (Babcock & Wilcox), Maine and Connecticut (Niclausse), Missouri, Wisconsin and Arkansas (Thornycroft), and Florida (modified Normand).

The foregoing gives the installation of water-tube boilers in our navy from which data has been obtained. So far as tried the boilers have invariably been easy of operation, though I have found more skill required to obtain the best results from these boilers than would have been necessary if cylindrical boilers had been used. Particular attention has been given in all cases to the feed arrangements. Water-tube boilers must have ample feed pumps, and the regulation of the feed must be easy. At first the heating surface of water-tube boilers was made 3 square feet per horse-power against 2 square feet necessary with cylindrical boilers. This figure has been gradually reduced until now we are down to 2.4 square feet of heating surface per horse-power, about as low as I think it is yet safe to go with water-tube boilers.

The economical results from water-tube boilers were at first not particularly good. At present we get quite as good results from water-tube boilers of the latest design as from the best cylindrical boilers. The ratio of heating surface to grate surface has been kept up to at least 40, although we do not yet feel warranted in allowing as small grate surfaces in water-tube boilers as in cylindrical boilers. Water-tube boilers lose in efficiency when forced, especially those of the straight-tube type. Of course, this is not of very great moment to us in a naval vessel which is under forced draught only at maximum speed, but it is nevertheless a disadvantage.

The following table shows the relative economy of cylindrical and water-tube boilers.

	Annapolis.	Marietta.	Newport.	Princeton.	Vicksburg.	Wheeling.
Type and number of boilers	(2 B. & W.)		(2 single-ended cylindrical).			
Displacement, tons	1000	1000	1000	1000	1000	1000
Knots per ton of coal at most economical speed	26.38	22.27	18	19.6	21.25	16.6
Number of screws	1	2	1	1	1	2
Grate surface, sq. ft	98	94	78	78	78	60
Heating surface, sq. ft	3620	3664	2524	2524	2524	2508

The increased grate surface we have required with water-tube boilers will be a positive advantage to our ships' steaming qualities. I consider that sustained sea speed depends largely upon the grate surface. Heating surface, of course, must be provided, but I should prefer an excess of grate surface to an exceedingly high ratio of heating surface to grate.

Up to this time we have had no trouble from salt water or grease in water-tube boilers. Indeed, we could hardly be more troubled by salt water with this type of boiler than we have been with cylindrical boilers. We suffered severely in our short war with Spain from dropped furnaces in cylindrical boilers. I do not think that a properly designed water-tube boiler will give more trouble from the use of impure feed water, such as sometimes we must have at sea, than any other boiler. I do not think tubes more liable than furnaces to fail from a deposit of scale. In any event, the evaporating plants of all our ships are being made adequate to give fresh feed water. The only danger of salt water in the future should come from leaky condensers.

Glancing abroad for a moment, we find every modern naval power, from England to Japan, committed to the use of water-tube boilers on the largest scale. Each of these countries has had its experience, and each has decided not only that water-tube boilers can be worked, but also that they work well and that they must be used in naval vessels.

I will give a few observations on the working of various types of water-tube boilers abroad. The result of a first glance would seem to be that anything would do to make steam, from Watt's tea-kettle to the most complicated of modern steam generators. I know of one French boiler (you know what ingenious mechanics the French are) composed equally of water and fire tubes. The tubes were concentric and the distance between them but one millimeter. Of course the amount of water is very small—so small as to put this boiler in the class called by their originators "inexplosible." This boiler was tried at the works of the maker with good results. It was next tried in a torpedo-boat with equally remarkable results—7 men killed, I believe.

We have read of explosions, however, of really well-designed water-tube boilers. Generally it is found that a tube had failed and that the furnace door was open—the results, more or less fatal burns to all in the fire-room. We hear of all the failures but the successes are never mentioned. It is not difficult to foresee the failure of a boiler plant designed to furnish 120,000 pounds of steam per hour but regularly required to furnish 160,000 pounds per hour. If nothing else fails, the feed pumps will not do the work and the tubes will, of course, be burnt out. This would happen with any type of boiler.

You see, I harp on the failures, for I find I can glean the most information from them. Many of the failures have come from the use of boilers that were inaccessible for cleaning and repairs; others from faulty design; others from poor workmanship; others, again, from neglect. Water-tube boilers require skilled attendance. Other boilers have failed from poor material; others from failure of the feed pumps; but there is not one, so far as I know, that can properly be said to have failed purely as a result of being a water-tube boiler. Failures may come from misusing water-tube boilers, but not from using them. I consider that the experience of the last ten years or more in our own and in foreign navies justifies me in stating that water-tube boilers, when proper precautions are used, can be successfully adopted for the steam generating plant of ocean-going vessels. They are necessities to the best design of warships.

I would naturally come now to a discussion of the claims of the adherents and opponents of water-tube boilers. You have all heard these arguments and it seems almost useless to go over them. I shall simply state what I believe to be the advantages and disadvantages of water-tube boilers compared with cylindrical boilers.

ADVANTAGES.

Less weight of water.
Quicker steamers.
Quicker response to change in amount of steam required.
Greater freedom of expansion.
Higher cruising speed.
More perfect circulation.
Adaptability to high pressures.
Smaller steam pipes and fittings.
Greater ease of repair.
Greater ease of installation.
Greater elasticity of design.
Less danger from explosion.

DISADVANTAGES.

Greater danger from failure of tubes.
Better feed arrangements necessary.
Greater skill required in management.
Units too small.
Greater grate surface and heating surface required.
Less reserve in form of water in boiler.
Large number of parts.
Tubes difficult of access.
Large number of joints.
More danger of priming.

A saving in space has been claimed for water-tube boilers, but I do not find this claim sound when account is taken of the increase in grate and heating surface necessary in water-tube boilers to insure satisfactory working, and because of small units the space for accessibility is increased rather than diminished.

The fact that water-tube boilers raise steam quickly is of the greatest advantage. I have stated elsewhere that I consider the battle of Santiago to have developed the necessity of the use of water-tube boilers whether it taught us anything else or not. It would have been of the greatest advantage to have had, during the blockade of Santiago, boilers capable of raising steam in less than half an hour. Coal need not have been used to keep all the boilers under steam all the time. The Massachusetts might have shared in the glories of the fight if she had been fitted with water-tube boilers. The Indiana would have kept up with the Oregon and the Texas. The New York would have developed at least three knots more speed and the navy would have been spared a controversy. I think the Colon would not have gotten as far away as she did. But we did not have the water-tube boilers.

The higher pressures possible with water-tube boilers give us smaller and safer steam pipes and better valves. It decreases the size of the fittings and the difficulty of tracing the labyrinth of a ship's piping. It increases the efficiency of the engines. The introduction of compound engines forced us to use cylindrical boilers. In the same way the use of quadruple expansion engines necessitates, for economy, the use of water-tube boilers.

But the quick steam-raiser is, because of that very fact, not so safe as its predecessor. Of course, nothing on a man-of-war is very safe in war time, but we want things as safe as possible, and the boilers are the keys to the situation in the modern battleship. I think that safety in handling water-tube boilers may be assured by using skill in the fire-rooms. I have more than ten years' successful experience with water-tube boilers on which to found this opinion, and I submit that the boilers, placed as they are behind the heaviest armor and below the thick protective deck, are, at the worst, the safest apparatus on a battleship. If we can make them work well, we would do wrong to refuse to use water-tube boilers on our ships.

For merchant and for yacht practice it is a different question. I was recently asked what boilers to use on a large steam yacht. I recommended cylindrical boilers. For merchant work the boilers are always in use developing a fixed power. Weight is not there so important as in warships, and I think it is at best a moot question whether cylindrical boilers are not still the best that can be fitted in ocean-going merchantmen. In some cases where there are short trips and the opportunities for repair must be gotten during the very short lay-ups at the end of the route, the quick steam-raising qualities of water-tube boilers, with their freedom of expansion, enable blowing down the boiler immediately on arrival in port and still having steam at an hour's notice on all boilers. Such cases as this seem to me to demand water-tube boilers.

As to the type of boiler to be used, there are as many to choose from as there are fleas on a dog. Some one has said that a certain amount of fleas keep a dog from brooding over being a dog. So the number of varieties we have to choose from may be a good thing for all.

I have always opposed the use of boilers containing screw joints in contact with the fire, and have attempted to secure boilers having no cast metal in the pressure parts. Cast-steel is not yet good enough to put between 300 pounds of steam and our firemen. I believe in straight-tube boilers as being easier of examination and repair than bent-tube boilers. I believe in large-tube boilers for the same reason and because the tubes are thicker and have more margin for corrosion. I believe in boilers having as few joints as possible. Water-tube boilers must have freedom of expansion of the various parts, and the simpler the boiler the better. It should not be necessary to introduce reducing valves between the boilers and the engines to secure a steady steam pressure at the latter, nor should it be necessary to have automatic feed arrangements to insure steady water level in the boilers. To be successful a boiler must be easy of repair. Lightness is a natural attribute of all water-tube boilers, but it is not wise to go too far in this direction. The ratio of grate surface to fire surface occupied for the complete boiler plant must be as large as possible. The units should be large, the grates short and not too wide. The passage of gases through the tubes should be sufficiently long to insure economy. These gases should be well mixed before entering the spaces between the tubes for the same reason and to prevent smoke. The circulation of the water in the boiler must be free. Tubes should not be too long and the fire-rooms must always be sufficiently wide to provide for free withdrawal.

The foregoing is what we want. We have most of the above desiderata in several well-known types of boilers, and ultimately we shall discover the value of each of the foregoing points, and then it will be possible to differentiate between the various types more perfectly than we now can.

In the meantime, all that I have to say is that the use of water-tube boilers has been definitely decided upon for our naval vessels, because water-tube boilers give tactical advantages of great moment, and because, with care in the selection, manufacture and management of water-tube boilers, other disadvantages may be neutralized.—*Scientific American Supplement.*

REPORT OF THE CHIEF OF THE BUREAU OF ORDNANCE.*

According to the annual report of the Chief of the Bureau of Ordnance, of the total of 939 main-battery guns authorized, 756 have been com-

* Extract from the annual report of Rear-Admiral O'Neil.

pleted and 751 assigned, while 13 are partially completed, and the forgings for 174 have been ordered. None of the 12-inch, 40-caliber guns are yet ready. The forgings have been ordered for the 5-inch 50-caliber guns, but none of this type are yet being made.

The new model guns have enlarged powder chambers and are of the following lengths, viz., 10 and 12-inch, 40-calibers; 8-inch, 45-calibers; 3, 4, 5 and 6-inch, 50-calibers. The first of the new 4-inch guns with its mount has been completed and tested. The gun exhibited excellent ballistic properties, a muzzle velocity of 2991 foot-seconds having been recorded within the limits of chamber pressure for which the gun was designed (viz., 17 tons per square inch), using navy smokeless powder not especially manufactured for this type of gun. It is expected that still better results will be obtained when the exact size of grain is determined for the powder. The first of the new 6-inch guns, with its mount, is nearly completed, and will soon be tested, and the first of the new 12-inch guns is assembled and in an advanced state. Two 8-inch nickel steel guns have been assembled. One of them is to be fitted with a quick-firing breech mechanism of new type, designed by Lieut. F. J. Haeseler, U. S. N., a similar mechanism fitted to a 4-inch gun having given good results. The satisfactory performance of the new 4-inch gun, which is made on the same design as regards chamber as the larger calibers, justifies the bureau in anticipating equally good results from the latter. The gun steel delivered by the manufacturers has been of excellent quality, and but very few forgings have been rejected. The process of gun manufacture is rapidly and accurately carried on at the naval gun factory, due to excellent machinery, new and good mechanical devices, and to the intelligence and skill of the operatives.

The new guns will be fitted with the "Welin screw" or breech-plug, which gives a proportionally larger threaded area than the plugs now in service, and therefore admits of a shorter and lighter plug, which is a matter of considerable importance, especially in the larger calibers. A new type of breech mechanism has been adopted for the 6-inch and 5-inch rapid-fire guns of 50 calibers which possesses several admirable features. It has great power to unlock, has a combination electric and percussion firing attachment, and an automatic ejection of the primer. These guns will not require brass cartridge cases.

The work on gun mounts has progressed simultaneously with the guns. The turret mounts of the four new harbor-defense monitors will have the same general characteristics as those for the Alabama and Maine class, but the construction has been improved in several important details. The first mount is well under way. A new type of 6-inch mount for the 6-inch gun of 50 calibers has been designed, and is nearly completed and will soon be tested. A new type of mount for the 4-inch 50-caliber gun has been designed, manufactured and tested with satisfactory results.

A 14-pounder (3-inch) rapid-fire gun is completed, and the mount nearly ready, and both will soon be tested. This is a new type of gun so far as the navy is concerned, and is intended for part of the armament of the new "destroyers," and probably will form an important part of the secondary battery of future battleships and large cruisers. It is designed for 3000 foot-seconds muzzle velocity, and, therefore, should have great range and a flat trajectory. Its remaining velocity at 3000 yards should be 1400 foot-seconds, which would give it a penetrating power of 1.52 inches of Harveyized steel, or 1.22 inches of Krupp armor at that distance, rendering it a destructive weapon against the unarmored portions and exposed gun positions of an enemy's vessels.

All the new guns are being fitted for a telescope sight, and for a bar sight for day and night use, designed by Lieut. H. D. Tisdale, U. S. N., an officer on duty at the gun factory, who has also been largely instrumental in improving the pedestal mounts above referred to.

New and improved ammunition hoists have been designed and manufactured for the 8-inch turrets of the New York and Indiana, and similar hoists are in an advanced state for the Oregon, Olympia and Massachusetts. Hydro-pneumatic rammers have been manufactured and installed on board the Oregon, Massachusetts and Indiana in place of the former hydraulic rammers, which were constantly giving out, and others are now in an advanced state for the older monitors, which are now supplied with hydraulic rammers. All the later ships are to be supplied with the chain rammer, which can be operated by hand or electric power.

A new type of combination primer has been developed at the torpedo station, and promises to give excellent results. The question of a means of reducing the temperature of magazines on board ship by connecting them with the refrigerating plant is now under consideration, and preliminary steps have been taken to introduce such a feature on the battleships now being built. Special attention is being given, in connection with the Bureau of Construction and Repair, to providing good means of ventilation for turrets, a matter that the recent war showed was most important.

Owing to the number of purchased vessels added to the navy during the recent war, the supply of reserve guns has been considerably depleted, and a further appropriation for them is asked. At the naval gun factory, at the Washington Navy Yard, 113 enlisted men have been under instruction and 80 at the torpedo station.

The batteries for the Kearsarge and Kentucky, with their accessories, have been completed, with the exception of the 5-inch guns and top carriages, which will be completed by the time the vessels are finished. The 13-inch guns of the Alabama and the turret fittings have been completed. The 6-inch guns are completed and their mounts will be ready in about two months. The 13-inch guns and mounts for the Wisconsin are completed. The 6-inch guns are completed and their mounts will be ready in about three months. The 13-inch guns and mounts for the Illinois are completed. The 6-inch guns and mounts will be completed in about four months. The entire ordnance outfit for all the above vessels will be ready in advance of the completion of the ships. A battery has been completed for the training-ship Chesapeake.

All the above vessels will receive entire outfits of smokeless powder.

The guns for the battleships Maine, Ohio and Missouri and the four harbor-defense monitors are under way, and they will be completed far in advance of the vessels, as will the armament of the Denver class. The launching-tubes for all new destroyers and torpedo-boats are completed, and their batteries will be ready in time.

The main battery of the battleships Maine, Ohio and Missouri will consist of four 12-inch guns of 40 calibers, and of sixteen 6-inch rapid-fire guns of 50 calibers.

The new monitors Arkansas, Florida, Wyoming and Connecticut will each carry two 12-inch 40-caliber guns and four 4-inch 50-caliber guns with shields. The six cruisers of the Denver class will each carry ten 5-inch guns of 50 calibers.

The development of the 12-inch gun has been so great that its adoption for recent vessels, rather than the 13-inch gun on the older vessels, became a logical sequence. It has a projectile of but 850 pounds weight as against 1100 pounds for the 13-inch gun, but the muzzle velocity will be not less than 2800 foot-seconds against 2300 foot-seconds. The muzzle energy will therefore be 46,186 foot-tons as against 40,404 foot-tons for the 13-inch gun; penetrating power at 3000 yards 17.92 inches of Harveyized nickel steel armor as against 15.91 inches. The racking and battering effect will be less. The new 12-inch gun will readily perforate any armor afloat or likely to be put afloat, and the bureau considers it a more suitable weapon for the new battleships than a gun of larger caliber.

The 6-inch rapid-fire 50-caliber gun for the new vessels will have a muzzle velocity exceeding 2900 foot-seconds, with a muzzle energy of not less than 5838 foot-tons. At 3000 yards they will have the power to penetrate Harveyized nickel steel armor of 5.3 inches in thickness, and they have a proving-ground record of ten rounds per minute.

The new 5-inch gun for the Denver class and the 4-inch for the monitors will be of 50 calibers and capable of developing a muzzle velocity of 3000 foot-seconds.

There are in service a considerable number of 6-millimeter automatic Colt guns, which, in general, have given good satisfaction. When they have failed it has almost invariably been due to neglect of some necessary precaution. Great accuracy is required in filling the belts; the parts move with great rapidity and the barrel becomes very hot after a short time, rendering it difficult to adjust any derangement which may occur. The bureau has ordered a 0.30-caliber Colt automatic to handle the army cartridge, for test and experiment. A 0.30-caliber Gatling, to handle the army cartridge, has also been ordered. The bureau is of the opinion that it will be found expedient to supply each vessel with a number of automatic guns of small-arm caliber, according to her class, and one hand-working gun. Under such conditions vessels will be in this respect well equipped for any service. A new type of fully automatic 3-pounder gun has been tried with promising results. Such a gun has a rate of possible fire of 70 per minute, as compared with 40 for the semi-automatic gun. It also has the advantage of having four shots in immediate readiness. This device can also be attached to the 6-pounder semi-automatic gun, and the bureau is having one so fitted for experiment.

The question of the supply of armor stands as follows: The contracts for the Kearsarge and Kentucky have been completed. Armor is now being manufactured for the battleships Alabama, Illinois and Wisconsin. There remains to be delivered for these vessels, 832 tons for the Alabama, 1255 tons for the Illinois, and 394 tons for the Wisconsin, a total of 2481 tons. Of this amount about 1000 tons will probably be delivered during the next six weeks. The armor contracts for these vessels will probably be completed by January 1, 1900, or thereabouts.

The delay in contracting for the armor for these vessels was due to the fact that Congress had limited the price.

By January, 1900, the contracts should be made for the armor for the three vessels of the Maine class. Such armor as can probably be procured for $400 per ton is not the best armor that can be made, and hence is not suitable for the vessels in question. The bureau urges that the matter be laid before Congress as soon as it assembles.

The question of a government armor factory should have no bearing upon the supply of armor for the Maine, Ohio and Missouri, as it would under any circumstances be impracticable to obtain it from such a source in time to complete the vessels above referred to. No detriment or inconvenience to the government or its interests has been caused by this delay; but, as previously stated, armor for the above vessels should be contracted for by January, 1900. If, after a further presentation of the case, Congress decides to adhere to the present limitation, the department will probably be obliged to procure armor similar to that heretofore and now being used, but it will have the consciousness of having performed its duty in the matter and will be free from further responsibility. It is quite evident that the building of armored ships of war must soon be discontinued by this government, until the vexed questions of the source of supply and cost of armor are disposed of.

Notwithstanding the improvements, the facilities of the gun factory are inadequate to meet the pressing demands of the service, and it is imperative that further extensions and additions be made.

During the year, 161 guns of various calibers have been proved. No weakness or defect has been observed in any of them, though usually subjected to pressures much higher than obtained in service. Numerous tests of armor plate for vessels now building have been made. Armor-piercing and common shell, representing numerous lots of all calibers, have been tested, with, in most instances, satisfactory results.

The bureau discontinued the purchase of brown powder as soon as the late war with Spain was over, and having a good supply on hand, which can gradually be used up for target practice, directed the powder manufacturers to give their attention entirely to the production of smokeless powder of navy standard, known as pyro-cellulose. It is most gratifying to the bureau to be able to report that thus far no unfavorable qualities have been detected in this powder when properly made. Its ballistic properties and keeping qualities appear to be excellent and to remain unimpaired even when subjected to excessive temperatures of heat and cold and to extreme degrees of moisture. No dangerous pressures are recorded, nor have any of abnormal character been observed in well-made powder of this kind. The question as to the best mode of ignition is now receiving considerable attention. The bureau has decided, as a precaution to be observed for a year or two, to fix rather small charges; this not only for the purpose of observation and safety, but that the guns may not suffer unduly from erosion, though the latter thus far is almost an unknown condition, which seems to be one of the very good qualities of the navy smokeless power, as compared with cordite and other powders containing nitroglycerin.

The uniformity of navy smokeless powder depends largely upon the rate and thoroughness of drying and upon the amount of solvent remaining in it when used. The specifications are, however, very explicit in this respect, and are fully understood by the manufacturers. The drying requires usually from four to six weeks, and where large quantities are turned out daily, the question of drying becomes a serious one, particularly so on account of the risk in case of fire, as a large amount of capital is kept in a precarious state pending the acceptance of the manufactured article. It is not unlikely that by processes other than those now followed, quicker drying can be effected.—*Scientific American Supplement.*

A NEW TYPE OF BATTLESHIPS—THE FRENCH HENRI QUATRE.

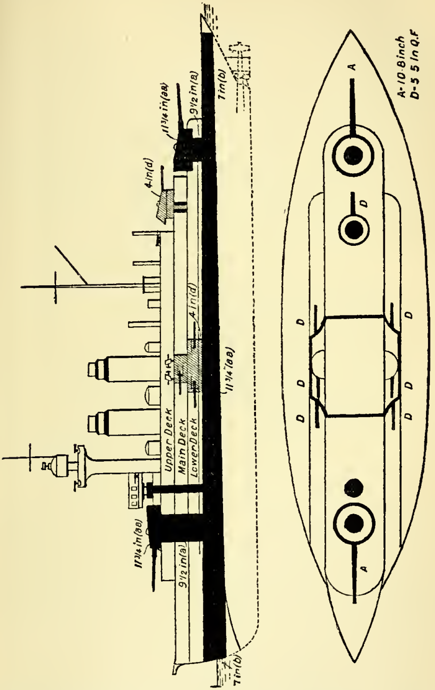
It is curious that while the launching of the Henri IV in France has been attended with a good deal of trumpet-blowing, prophecy, and what not, the affair has produced next to no notice in this country, and such little attention as it has received has been confined to irrelevant remarks to the effect that the ship has broken no record in construction. Yet—for the present, at any rate—the Henri IV marks an epoch in French naval construction of little less importance than the launch of La Gloire, the first sea-going ironclad. The Henri IV is avowedly an experimental ship, and one of which great things are expected, and which, if as successful as anticipated, will be adopted as the standard model for finality in battleship construction. If she is a success, other ships may be constructed larger and heavier, but they will be identical in type. Herein is surely a matter of some moment to us, even apart from the ordinary interest that attaches to such a revolutionary design. For, mixture of the circular Russian ironclad Vice-Admiral Popoff, of the Inflexible, and of the modern Bouvines as the Henri Quatre is, she is none the less, for the French, an absolute revolution. She marks, amongst other things, the abandonment of the sky-scraping superstructure to which the French have so long adhered; she marks also a "throw-back" in design, a throw-back to the later seventies.

Let us first consider the ship's measurements, the proportions in which finality is chiefly sought, comparing her with the ships she mostly resembles in appearance, and with the Charlemagne type that preceded her:

	Henri IV.	Inflexible.	Popoff.	Bouvines.	Charlemagne.
Date	1899	1876	1875	1891	1895
Displacement, tons	9000	11,800	3550	6610	11,260
Length in feet	350	320	120	292	381
Beam, feet	73	75	120	50	67
Draught, feet max.	23	29	13½	24½	28

The Bouvines, it should be remembered, is 5 feet broader than her immediate predecessor, the Valmy, of the same general type. Now the proportions of length to breadth in these compared ships are, roughly: (Circular) Popoff, 1:1; Inflexible, 4.3:1; Henri IV, 4.8:1; Bouvines, 5:1; Charlemagne, 5.7:1.

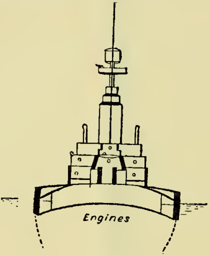
The average proportion of length to beam for French battleships has been about that of the Charlemagne hitherto, the Bouvines being the first departure. As most of our readers are aware, the Valmy, from which the Bouvines is derived, is a low freeboard ship, completely belted, with a big gun forward, another aft, and a superstructure between. This type did not behave well at sea, so the Bouvines and Trehouart were built with raised forecastles. In this the Henri Quatre directly follows the Bouvines. Where she differs from the Bouvines, and from every other modern ship, is in the fashion of her hull. Like the Bouvines, she has a high forecastle; like the Bouvines, she carries one big gun on this, and the other at a lower altitude aft, but here resemblance ceases. Directly the sides leave the immediate bow they no longer follow the water-line, but a straight line inboard, the idea of twenty years or more ago, when the Inflexible was built, and abandoned with the Austro-Hungarian Kronprinz Rudolf, launched in 1887. Experience has taught us that these ships will take water on the deck, and that this water is a nuisance in every way. The French claim as a feature of the Henri Quatre that, having her decks thus open, she has nothing to fear in



FRENCH BATTLESHIP HENRI QUATRE.

action from water finding its way on to the lower deck. "It can run where it chooses."

However, 1899 is not 1876, and for 1876 brought up to date there is more than this to be said. To begin with, the Henri IV is so built that the lower deck slopes away aft at an angle sufficient to make the water run fast in that direction. There are holes aft, too, to carry it away. Further, the armor deck is a different thing now from what it was in those days, and the Henri IV is really that "ship upon a raft body" of which we heard so much in past years. She is, to begin with, armor-belted, except in the extreme stern, where a bulkhead takes the place of armor, following the sharp V shape of the stern; this V being an addition to her length that minimizes her paper breadth. To all intents and purposes the hull is only some 325 feet long, and the stern is merely a projection. The thickness of the belt—which is Harveyized—varies from 11¾ inches to 7 inches—the "war-game notation" is given in the plan. This is reinforced by a curved armor deck, the deck itself is also armored, the total thickness being 3 inches. Below the belt is another armor deck of 1 inch, specially hardened steel. In addition there is, of course, coal bunkers' protection.



HENRI QUATRE—END VIEW.

The big gun turrets are on the French system, with 9½-inch supports and bases and 11¾-inch hoods. Each carries a 10.8 gun, with an initial velocity of 2625 foot-seconds and an energy of about 22,750. This is only about two-thirds of our ordinary 12-inch wire. Still, it is sufficient to get through nearly any armor afloat at 1000 yards or more. Over the after big gun a 5.5-inch quick-firer is mounted. In the battery six more are carried. All have a protection of 4-inch Harvey, and hence are open to shot from a 6-inch quick-fire gun. However, this 4-inch will keep out shell from that piece.

It is not yet clear whether the rest of the hull between the lower and main decks will be armored; the presumption is that it will not be, since a 9000-ton ship could hardly, perhaps, carry it in addition to all the other armor. Other details the plans and illustrations make apparent.

Now, the most casual comparison of the ship with previous French models must render obvious the increased stability of the Henri IV. There are no enormous weights projecting amidships, no huge superstructures the destruction of which must affect stability. She is built not to capsize. At the same time the vessel offers some weak points; the pillars on which the big guns stand are a sorry substitute for our huge armored bases, and persistent shell-fire around these should leave a somewhat top-heavy concern, that forward, at least, might well capsize with the stress of firing. As for the battery, one big shell or a number of 6-inch shot would settle the six central quick-firing guns; the weak point of a concentrated armament is accentuated here by the thin redoubt and its comparative narrowness. No doubt screens will be fitted inside it, still a single big shell is pretty certain to "do up" the whole concern. When all is said and done, however, the weakness of the Henri IV is, perhaps, rather on paper than in fact. At sea she is more likely to do better than worse than she looks on paper, and compared to the generality of French ships she is an infinitely smaller target.

In armament she carries, in addition to the pieces named, twelve 3-pounder quick-firers, and probably a couple of submerged torpedo-tubes. Her exact torpedo armament seems as yet in some doubt. Comparing her armament with some other vessels of about her tonnage, we find that it is by no means excessive; indeed, it is the French who say that English ships carry too many guns.

The following are the comparisons:

	Henry IV.	Sissoi Veliky.	Rostislav.
Main armament.....	two 10.8-in. (A)	four 12-in. (A)	four 10-in. (B)
Secondary..........	seven 65.5-in. (D)	six 6-in. (D)	eight 6-in. (D)

These are the only modern vessels of displacements anywhere near 9000 tons.

All the Henri IV's guns are electrically worked. Her normal coal supply is 725 tons, the capacity of the bunkers is 1100. Nominally, this stands for 7500 miles at 10 knots with full bunkers. The Sissoi and Rostislav only carry 500 tons with a maximum of 800, and a nominal 2000-mile radius.

She will be fitted with Niclausse boilers. The designed horse-power is 12,000; there are three screws, and the expected speed is 17 knots. With her shape the Henri IV in anything of a sea is likely to be nearer 12 knots than 17 knots. Vessels on this model—for her shape is very akin to the Inflexible's in many ways—duck their noses tremendously in any seaway, and tons of water come upon the low decks. How much they will get in this way, the French have yet to discover.—*The Engineer.*

JAPANESE TORPEDO-BOAT DESTROYERS.

In a late issue we very briefly noted that the official trial had taken place of the fourth out of the six torpedo-boat destroyers that have been under construction during the past year by Yarrow & Co., Limited, of Poplar, for the Imperial Japanese Navy.

The Sazanami, on her three hours' official trial attained the exceptional mean speed of 31.382 knots an hour. This vessel, like the three that have preceded her from her builders' yard at Poplar—two of which have already arrived in Japan and proved themselves excellent sea boats—is 220 feet long by 20 feet 6 inches beam, and is propelled by twin screws. She is built of galvanized steel of extra strength, the longitudinal seams in her hull plating being joggled, instead of fitted with the old-fashioned lining strips on the frames; the upper strakes having the rivet-heads projecting instead of being countersunk, so supporting the plate and helping to stiffen it.

The propelling machinery of the Sazanami consists of two sets of four-cylinder four-cranked triple-expansion engines of Messrs. Yarrow's well-known make; the high and intermediate-pressure cylinders being 20½ inches and 31½ inches diameter respectively, the two low-pressure cylinders, which are placed at the forward and after ends of the sets, are each 34 inches diameter, all having a piston stroke of 18 inches.

Steam is supplied by four water-tube boilers of the Yarrow straight-tube type. The engines, which are designed to develop 6000 indicated horse-power, are balanced on the now well-known Yarrow-Schlick-Tweedy system; their reversing being effected by direct action, and not on the so-called all-round system, the action being remarkably quick, and as proved in handling them, specially suitable for high-speed engines.

The main steam pipes of the engines are of mild steel solid drawn, and are fitted with special expansion joints to prevent any working of the ship's hull putting an undue strain upon the pipes, independent of that caused by their expansion by heat.

The coal stowage of the Sazanami is from 90 to 100 tons, sufficient to carry her at a fair speed across the Atlantic. The accommodation for officers and crew is also exceptionally good, and the lighting throughout is electric.

A fact specially noticeable in connection with the steaming of the vessel is the ample margin provided in boiler power, each boiler being able to supply 100 horse-power beyond that required to develop the engine power contracted for. This feature was specially marked on the vessel's trial, and is proved by the absence of any discoloration in either of her four funnels, the paint on which had not been renewed since the day she was launched, accounted for by the low air pressure necessary when under forced draught and the absence of any flaming.

On the official trial of the vessel, the dead load carried was 35 tons, and the mean result attained, with the engines making a mean of 392 revolutions a minute, was a mean speed of ship of 31.38 knots an hour, the air pressure in stokeholds being 1⅜ inches, and the coal consumption during the three hours' running 15½ tons.—*The Engineer.*

ARMOR FOR NEW RUSSIAN SHIPS.

We give herewith a report showing the result of an extremely important plate trial, namely, the test on supply, of the plates made by Messrs. Carnegie for the quick-firing batteries of the Russian battleship Retvizan, building at Cramp's yard, Philadelphia. It may be seen that this shows a great advance in defensive power. Any reader of Brassey's or the *Pola Annual* may see that very few foreign battleships have armor 5 inches thick in front of their quick-firing guns, and this Krupp process plate has far greater resisting power than those hitherto made. England, happily, has long covered the quick-firing guns of her principal battleships with 6-inch Harveyed, and latterly Krupp process armor. Other nations have generally contented themselves with far less protection. By the time the Retvizan and ships similarly protected are afloat, we shall need the more powerful quick-firing guns which are contemplated, whether 7.5-inch or 8-inch. It may be seen that no projectile in this test approached perforation near enough to be able to estimate the full resisting power of this plate. The heaviest blow was that of No. 4 round, which had a striking energy of 1528 foot-tons, and by Tresidder's formula a perforation of 11.5 inches of iron, so that the factor or figure of merit of a plate which just keeps out such a blow is 2.3, that is, the plate would be equal to 2⅓ times its thickness in wrought iron; but since this blow did not approach perforation, the plate had a considerably higher figure of merit, so that it would need more favorable conditions than generally occur on service for our 6-inch guns to master it. It is to be noticed that the plate showed signs of yielding, not in front of the point of the shot, but round the circumference, so that "boring" had been completely defeated, and perforation would have to be effected by punching out a disc. This involves waste of energy in setting up the head, increased requirement of energy to get through even by punching rather than boring, and it involves the shot having the dislodged disc of plate in its way after it gets through.

Efforts are being made by all makers to give hard faces to thinner plates, but up to the present time the tendency to warp has prohibited it for plates below 4 inches in thickness, and the hardening of thin steel is a recent achievement at Sheffield, and we question if foreign makers have got further, if as far. The best thin armor is generally now that known as Krupp non-cemented, which is hard and tough, but has not the adamantine water-hardened face found in thicker plates.

On the other hand, the manufacture of really thick Krupp process plates is a work that taxes the power of manufacturers at first. Messrs. Carnegie have, we understand, so far progressed as to have a thick plate now ready for trial. The peculiarity of the Krupp process, and the circumstances—among them the clear grasp of the situation by Sir W. White—combined to provide the quick-firing guns of our armor-clads with a protection out of all proportion to that of other vessels. We hope this will be borne in mind by any powers who are inclined to test our ships, remembering that the principal fighting is done by these guns.

On September 20th, at Indian Head, the Krupp ballistic plate R. N. P. 179, representing the first group of armor for the Russian battleship Retvizan, was tested. This plate was 126$\frac{11}{16}$ inches long by 91⅝ inches wide and 5 inches thick. The plate was trapezoidal in shape, with one edge beveled. It was backed in the usual manner with 12 inches of oak timbers, and two ⅝-inch skin plates. Facing the plate as mounted, the left-hand edge was the bottom of the plate with reference to the ingot, the beveled edge being on the right hand.

The first point of impact was taken near the center of the plate, at a distance of 41 inches from the bottom edge, and 61 inches from the left-hand edge. Midvale 5-inch uncapped a. p. shell, No. 91 of lot 21 made in the present year, was selected for this round. The charge of powder was 12.55 pounds, of C. S. B. 14 smokeless powder. The shell broke up on the plate, leaving a small portion of the point of the shell embedded in the plate; the rest of the shell was scattered in small pieces. The estimated penetration was 2 inches. The plate was dished ⅛ inch. The average diameter of the flaking was 12½ inches. The metal of the face of the plate was very hard, and of fine dark grey crystals, super-carbonated near the surface. The striking velocity, as measured through the screens, was 2060 foot-seconds, the required striking velocity being 2058 foot-seconds.

The same charge of powder was used in each of the succeeding rounds.

In the second round a 5-inch Wheeler-Sterling uncapped a. p. shell, No. 2295 of lot 19, was selected. This shell also was made this year. The second point of impact was taken at a distance of 29 inches from the left-hand edge of the plate, 32 inches from the center of the first point of impact, and 42 inches from the bottom of the plate. The shell broke up as in the preceding round, with the same estimated penetration and dish of plate. The average diameter of flaking was 12 inches. The striking velocity was 2086 foot-seconds.

For the third round Carpenter 5-inch uncapped a. p. shell, No. 4718 of lot 14 of the present year, was selected. This point of impact was taken at a distance of 43 inches from the bottom of the plate, 27½ inches from the center of the first point of impact, and 25 inches from the right-hand edge of the plate. The shell broke up as in the preceding rounds, the dish and penetration being the same, and the average diameter of the flaking 10½ inches. The striking velocity was 2057.

For the fourth round a Midvale 5-inch uncapped a. p. shell of lot 20 was used. The point of impact for this round was 23 inches from the top of the plate, and 49 inches from the right-hand edge. The striking velocity was 2099 foot-seconds. The estimated penetration was about 2 inches, as in the preceding rounds. The average diameter of the flaking was 14 inches. The shell broke up, as in the preceding rounds.

For the fifth round a Wheeler-Sterling uncapped a. p. shell, No. 2054 of lot 18 of the present year was selected. This point of impact was taken at 19 inches from the bottom of the plate, 41 inches from the center of the first point of impact, and 61½ inches from the left-hand edge of the plate. The shell broke up as in the preceding round, having attained the same estimated penetration of 2 inches. The plate was dished ¼ inch. The average diameter of the flaking was only about 5½ inches. The striking velocity was 2082 foot-seconds. This impact detached a large piece of the face of the plate under the first point of impact, showing more fully the fine quality of the metal. In all of these impacts the wedging action of the shell was clearly shown in the cracks round the edge of the flaking, indicating that if the velocity were sufficient to cause perforation it would be done by driving out a large piece of the plate. There were no cracks in the plate.

The weight of shell in each round was 50 pounds. The striking energies were 1471, 1508, 1466, 1527 and 1502 foot-tons.

It is hard to estimate what the ultimate resistance of this plate would be with the shell used, but it is evident that the plate would have stood a very considerable increase of velocity from that used. Admiral O'Neil expressed his opinion most decidedly that it was the best plate ever tested in this country.—*The Engineer.*

PROGRESS OF THE PARSONS STEAM TURBINE FOR MARINE PROPULSION.

A company styled the Parsons Marine Steam Turbine Company was formed late in 1897 for the purpose of taking over the rights and property of the original organization which built and tested the Turbinia.

The company has now in hand two torpedo-boat destroyers of large power and high speed, one, we understand, being for the British Government, and the other for Armstrong, Whitworth & Co. One, if not both, of the vessels is fitted with two separate sets of engines for the port and starboard sides respectively, and four propeller shafts. One each side the outer shaft is driven by a high pressure turbine, and the inner by a low pressure turbine, the inner shaft having also a small reversing turbine connected up. The total power available for going ahead is 10,000 I. H. P., which, on the dimensions, is calculated to give a speed of 35 knots. There is enough power available for reversing to send the boat astern at 16 knots. Condensers are fitted for each set of engines, and the air pumps are driven by small turbines, so that all reciprocating parts are got rid of, together with the probability of annoying vibrations which the usual form of pump would set up. For boiler feed steam pumps of the Weir pattern are fitted. Lubrication of the main bearings is secured by a system of forced oil circulation.

To get this amount of propulsive power upon the displacement of the regular 30-knot destroyer means, of course, a saving of weight somewhere, and in this is pointed out one of the advantages of the turbine method of propulsion. The engines are of less weight though of vastly more power than reciprocating destroyer engines, and the saving here is made use of in the needed enlargement of the boiler capacity. This amounts to about 12 per cent. in size. A gain is also expected in the steam consumption of the turbines as compared with the most economical form of the reciprocating type of engine. There is also a saving in weights of shafting and propellers. In a destroyer of 310 tons displacement it is estimated closely that the saving in machinery weights will permit of an increase of the steam-raising capacity to the extent of about 2000 square feet of boiler heating surface. It is also claimed by the inventor that on account of the absence of heavy reciprocating parts, linkage, etc., in the engines that they can be made with a larger margin of strength and capacity than reciprocating engines.

A comparative statement is made between a destroyer of 320 tons displacement equipped with express water-tube boilers and turbine engines of about 12,000 I. H. P. and a destroyer of say 300 tons displacement with express water-tube boilers and reciprocating engines of about 6000 I. H. P., as follows:

	Turbine Destroyer.	Regular Type.
Boiler-room weights with water in boiler	225,680 lbs.	174,720 lbs.
Engine-room weights with auxiliary gear and water in condensers........................	117,185 lbs.	125,440 lbs.
Weight of propellers and shafting, etc..	17,304 lbs.	22,400 lbs.
	360,169 lbs.	322,560 lbs.

Consequently the weight of machinery of the turbine destroyer figures out 30.01 pounds per indicated horse-power, and that of the ordinary type destroyer exactly 53.76 pounds per indicated horse-power. The hull of the turbine destroyer can also be made lighter, as the rotary motion of the turbine and absence of vibration make it possible to dispense with the added weights at the after end for structural strength, such as are demanded with the reciprocating form of engine.

It will be remembered that a series of observations were made by Prof. Ewing on the Turbinia when she came out, at the request of the owners. The important question of steam consumption, among others, received special attention. The indicator could not, of course, be applied to the turbine form of engine, and so the resistance of the vessel derived from tank experiments was used as a basis for computing the horse-power at any speed up to a maximum of 32 knots. An exact record of the amount of feed, etc., used was also kept, and from the data thus secured the steam consumption for all purposes at the 31-knot speed was found to be 28 pounds per propulsive horse-power. This, on the basis of 55 per cent. of propulsive to indicated horse-power, gave a steam consumption of 14½ pounds per indicated horse-power, and the coal consumption was rather less than 2 pounds per I. H. P. per hour.

How far these expected results will be reached or surpassed in the vessels under construction remains to be seen. Recent brief telegraphic reports seemed to indicate that the preliminary trials of one of the vessels were not satisfactory, but this is no criterion. Some detail of construction or equipment which might have no bearing whatever upon the efficiency of the machinery could, reasonably, be responsible for delay or disappointment.

No doubt the success of boats of the character of those now in hand would greatly aid in a more wide-spread adoption of the turbine form of propulsion. It is claimed for this type of engine that with larger engines, such as would be needed for full-powered sea-going vessels, the conditions for the highest economy in steam with a minimum of weight, could not be more easily met. While as yet no orders for the equipment of large mercantile vessels have been booked by the company, some work has been done in the direction of design. Plans have been prepared for an installation in a proposed ocean liner giving a total of 38,000 I. H. P. and an estimated rate of sea speed of 26 knots. The proposed vessel would have these dimensions: Length between perpendiculars, 600 feet; beam, extreme, 63 feet 3 inches; depth, molded, 42 feet; draught to bottom of keel, 28 feet; displacement, 18,000 tons; total bunker capacity, 5000 tons. Making a comparison as to machinery weights between the proposed vessel and a liner of similar dimensions with reciprocating engines of about 26,000 I. H. P. and Scotch boilers, the result would be:

	Turbine Liner Water-Tube Boilers.	Regular Type Scotch Boilers.
Boiler-room weights with water in boilers.....	1364 tons	2225 tons
Engine-room weights with auxiliary gear and water in condensers..........	822 tons	1220 tons
Shaft and propellers..........	210 tons	305 tons
Totals..........	2396 tons	3750 tons

The machinery weights of the turbine liner figure out 141 pounds per indicated horse-power; and those for the regular type liner 323 pounds per indicated horse-power. The comparative table shows a saving of 1354 tons in the machinery weights for the turbine-driven vessel over that with reciprocating engines on the same displacement, but the larger portion of this is to be credited to the water-tube boilers. In the engine-room weights taken alone the difference in weight is almost 500 tons. Were less speed required and the turbine liner powered to the extent only of the liner fitted with reciprocating engines, the saving in machinery weights would be very large and add greatly to the earning capacity of the vessel.

The advantages which, it is claimed, would result from the substitution of steam turbine machinery in a liner would be:

(1) A reduction of total engine-room weight to about one-half that of ordinary engines. (2) A small reduction in steam consumption per indicated horse-power. (3) Complete freedom from all vibration from the

main engines, and a great reduction of vibration from the screw propellers. (4) A smaller engine-room staff to deal with the simpler and lighter engines and shafting. (5) Less consumption of oil and stores.

Commenting on these claims, *Engineering*, London (to which we are indebted for many of the foregoing particulars), remarks that the perfect balancing of the engines permits of very light engine-room foundations, and obviates that stress or strain on the hull, which is produced by the reciprocating forces of ordinary engines. The absence of lubricant from the internal parts of the engines is a benefit to the condensers and boilers. It diminishes the cost of cleaning and repairs, and enables very high boiler pressures to be used without risk. It is proposed that the steam should be reheated between the high- and low-pressure cylinders by coils of steel tubes containing steam at boiler pressure. Compound feed heaters, supplied with steam drawn from several points in the expansion in the main engines, would raise the temperature of the feed to above 212 deg. Fahr. The exhaust from the auxiliaries would also be added to one or more of the heaters. The trials of the Turbinia showed a total consumption of steam for all purposes of 14½ pounds per indicated horsepower of the main engines at 31 knots, but in a liner the consumption would undoubtedly be less owing to the larger size and more perfect expansion, the higher boiler pressure, better vacuum and other minor details. Smaller size of the screw propellers diminishes vibration due to uneven action of the blades in the stream lines of the vessel. Smaller diameter also permits of some 8 feet more immersion above the tips of the blades, so that the evils of screw racing in heavy weather will be mitigated, and the vessel better able to keep her speed.

With the steam turbine the turning moment on the shafting is absolutely uniform, and these engines have much more momentum (or flywheel inertia) than ordinary engines. They will, therefore, not gather speed so quickly should the screws top the surface, and the engine governor will have more time to come into action and prevent racing. The shafting is only about one-half the usual diameter for equal total indicated horsepower, and can, therefore, be much more easily dealt with by the staff, and spare parts more easily carried. The four shafts are an additional safety against total breakdown of the engines; and should one of the engines break down the other three are not interfered with, as they are quite independent excepting as regards the steam supply, which is controlled by valves. The small headroom required for the turbine engines and their quiet working permits of cabins being placed over part of the engine-room.—*Marine Engineering.*

TRIALS OF TORPEDO-BOAT VIPER.

The Parsons turbine has again proved its ability to drive a torpedo-boat at very high speed. On the official trial of the Viper, a 325-ton destroyer for the British Navy, equipped with compound turbines of 10,000 horse-power, a speed of slightly over 32 knots, or 37 miles an hour, was realized at ¾ horse-power. When she develops her full horse-power, the contract speed of 35 knots will probably be realized.—*Marine Engineering.*

OUR NEW FLEET OF TORPEDO-BOAT DESTROYER

It is only of recent years that the United States Government has unde taken the construction of torpedo-boat destroyers on an extensive scal but thanks to the acts of Congress in the years 1896, 1897 and 1898, w have now either built or building no less than thirty-seven torpedo-boat and sixteen destroyers, a total of fifty-three of these formidable littl craft. At present we have no torpedo-boat destroyers proper, in com mission in our navy, the nearest approach to this type being such boat as the Porter and the Dupont, of 165 tons displacement and between 2 and 29 knots speed. There are other vessels much larger than thes nearing completion, if not already commissioned, which while the would undoubtedly be capable of accompanying a fleet to sea and ar fully as large as some of the torpedo-boat destroyers in other navies, ar not listed as such in the official tables of the Bureau of Construction an Repair. Such are the 30-knot vessels Bailey of 235 tons, Farragut of 27 tons, Goldsborough of 247.5 tons, and the Stringham, a large boat of 34 tons, which is expected to develop 30 knots with a total horse-power o 7200.

Sixteen torpedo-boat destroyers of the Bainbridge class were authorized in May of the year 1898. The contracts for these vessels were let in the fall of the same year and the contract date of completion lies in the early months of the year 1900. They are all nearly alike in the general arrangement of the engines, boilers, armament, etc. There are minor differences which are indicated in the subjoined table.

Name.	Number of Vessels.	Length.	Beam.	Draught.	Displacement, tons.	Horse-power.	Speed, knots.	Bunker capacity.	Torpedo-tubes.	Armament.
		Ft. in.	Ft. in.	Ft. in.						
Bainbridge...	9	245	23 7½	6 6	420	8000*	29	139	2-18 in.	2-12 pdr., 5-6 pdr.
Hopkins......	2	244	24 6	6 0	408	7200	29	150	"	2-12 pdr., 5-6 pdr.
Lawrence	2	243 3	22 3	6 2½	400	8400	30	115	"	2-12 pdr, 5-6 pdr.
Worden	3	248	23 3	6 0	433	8300	30	232	"	2-12 pdr., 5-6 pdr.

* The Paul Jones, Perry and Preble are to indicate 7000 horse-power.

Nine of the destroyers are of 420 tons displacement and will develop speeds of 28 and 29 knots with 8000 indicated horse-power. They will be known as the Bainbridge, Barry, Chauncey, Dale, Decatur, Paul Jones, Perry, Preble and Stewart, being named after heroes whose names are associated with the most brilliant episodes of our naval history. It should be noted that the three last-named of these vessels, which are being built by the Union Iron Works, of San Francisco, are guaranteed to give a speed of 29 knots with 7000 instead of 8000 indicated horse-power. Each destroyer will carry on the main deck two torpedo-tubes for the discharge of the 18-inch Whitehead torpedo. The armament will consist of two 12-pounder rapid-fire guns carried, one forward and one aft, above the conning towers and protected by shields. There will also be five 6-pounders carried in broadside on the main deck. These vessels will have a length of 245 feet, a beam of 23 feet 7½ inches, and a draught of 6 feet 6 inches. They will be capable of carrying 139 tons of coal closely stowed in their bunkers, and the complement will consist of four officers and sixty men. One excellent feature, which will give them considerable advantage over some of the latest boats that have been constructed for foreign navies, is that in addition to their relatively large size they are provided with a long forecastle deck which gives them an extreme freeboard forward of 14 feet, the freeboard amidships being about 9 feet. This will considerably improve their speed in steaming to windward in heavy weather. Three of these vessels are being constructed by Neafie & Levy, Philadelphia; two by William R. Trigg & Company, Richmond, Va.; three, as mentioned, by the Union Iron Works, of San Francisco; and one by the Gas Engine and Power Company, Morris Heights, N. Y.

The Hopkins and the Hull, which are being built by the Harlan & Hollingsworth Company, Wilmington, Del., are somewhat smaller vessels. They have about the same length, a foot more beam, and 6 inches less draught with a displacement of 408 tons. They are to achieve 29 knots with 7200 indicated horse-power, and the bunker capacity will be 150 tons, the armament and the complement of officers and crew being the same as for the Bainbridge. The Lawrence and the Macdonough, which are being built by the Fore River Engine Company, Weymouth, Mass., are the smallest vessels of the fleet. They will be of 400 tons displacement and they are to achieve a speed of 30 knots with 8400 indicated horse-power. The coal capacity will be less, namely, 115 tons; particulars of the armament and the complement will be the same as for the other vessels. The largest of the fleet will be the Truxton, Whipple, and Worden, building by the Maryland Steel Company, at Sparrows Point, Md. They will be 248 feet in length, 23 feet 3 inches beam, and on a draught of 6 feet they will have a displacement of 433 tons. They will have the large bunker capacity of 232 tons—a very valuable feature—and they are to make a speed of 30 knots with a development of 8300 horse-power.

These destroyers when completed cannot fail to produce a favorable impression. Their size, roominess, coal capacity, and powerful armament, and above all their good sea-going qualities, and high speed, will place them in the very front rank of this type of vessel.—*Scientific American.*

THE LAKE SUBMARINE BOAT.

Six years ago the Congress of the United States made provision for the building of a submarine torpedo-boat, and plans or designs were submitted by a number of persons. After some deliberation the award was made to the Holland Submarine Boat Company, the guiding spirit of which was John P. Holland, the inventor and builder of the much-discussed "Fenian ram" of the "seventies." Among the other plans submitted was one by Simon Lake, which, while not promising the idealism of the Holland craft, was to be able to navigate awash on the surface or totally submerged and traveling along on the bottom. To-day, the Holland boat ordered in 1894 is about 86 per cent. completed and likely to undergo serious modifications before declared ready for trial, while the Lake boat, called the Argonaut, has proved its entire practicability and is in its second edition, for a working and commercial duplicate has recently been put overboard at New York in the shape of the New Argonaut. In one of these rival boats the inventor claims that we have a dream of the happiest sort realized, while in the other, as she lies literally tied up in Baltimore, there is the disagreeable guarantee of sudden death should aught go wrong with her while under water, and the fair assurance at all times of roasting within the cramped compass allotted to the human elements that are to control her in action.

Argonaut No. 1, as we shall call the boat of 1897, made several experimental cruises about the harbor of Baltimore and down to the head of Chesapeake Bay in the latter part of 1897 and the early months of 1898, just prior to hostilities with Spain.

Believing the Argonaut to be susceptible of naval or military application, although really built for wrecking work, Mr. Lake proceeded on an extended cruise down the Chesapeake, up some of its tributaries, and around to New York City, making no fewer than a hundred descents, and covering a distance of something like a thousand miles, all told, and in all kinds of weather. At no time was she in danger, and at no time was her complement of five persons inconvenienced or uncomfortable in any way.

The principal facts claimed to be established about the vessel were:

(1) That she could be perfectly controlled while submerged, and when rising again to the surface, or that she could be held steady, *i. e.*, immovable, at any desired depth.

(2) That she could travel on any kind of bottom. In many cases she found mud so deep that a diver who was sent out sank to his waist, yet she ran easily and freely. Much of the bottom, especially on the coast, was almost level, of hard white sand, and quite as smooth as a macadamized road.

(3 That greater speed could be obtained while submerged than when running on the surface. This was undoubtedly due to the fact that there was a much greater head of water over the screw, making it more efficient, while completely doing away with wave-making resistance.

(4) That no greater perceptible power was required to run up steep hills than when running on the level, owing, no doubt, to the fact that the vessel was kept so nearly buoyant.

(5) That the crew was as comfortable when submerged as when on the surface. The Argonaut remained below at one time for ten hours and fifteen minutes. During this time the door was opened, clams and oysters were picked up from the bottom, and the cook prepared a hot meal, consisting of clam fritters, coffee, baked beans, etc.

(6) That telephonic communication could be maintained with the outside world while the boat was submerged. From the bottom of the Patapsco River the Argonaut was in communication with Baltimore, Washington and New York.

(7) That the Argonaut is a success for finding cables, and for repairing and cutting them. By running over the bottom with the door open, a cable in the Patuxent River was picked up with a short hook, dragged into the boat, and cut.

(8) That the compass is as trustworthy under water as above it.

(9) That divers could readily pass out and into the vessel while submerged, no water coming into the boat while the door was open.

(10) That although storms raged on the surface the Argonaut, when surmerged, was not in the least affected.

The air supply and air-exhaust pipes, for the sake of mutual support, were run together like the sides of the letter A, and reached to a height of 40 feet above the deck. This is done away with in the new boat, and flexible hose reaching up to a boat-shaped float will form the source of air supply and the means of exhaust for foul air and the gases from the engines.

Argonaut No. 1 is 36 feet long, has a beam of 9 feet, is circular in cross-section, and is of something like 57 tons displacement when entirely submerged. She is built of steel plates ⅜ inch in thickness, and double-riveted over strong steel frames spaced about 20 inches from center to center, and has a single 30 horse-power gasoline engine, which propels her both on the surface and when submerged, besides running all the auxiliary machinery for pumping, for compressing air, and for generating the energy for the electric lights. Air is stored in strong steel cylinders. All compartments have telephonic means of communication, which is further extended to the divers working without and beyond the vessel. The New Argonaut is a substantial duplication of the older Argonaut form—the cross-section also being round, but for superstructure she carries a boat, or ship-shaped structure of fine lines, which blend easily with the main body of the stouter cigar-shaped phase of the craft. In this lighter part of the craft will be carried the air tanks and the gasoline reservoirs safe from the reach of fire within the body of the boat.

On the deck of the upper body there will be a steel chart or pilot-house, from where the boat will be conned in rough weather when running awash. This pilot-house is elliptical and within it are the controlling mechanisms for the air supply, water ballast, and other things contributive to the skipper's management of the vessel. In fair weather the vessel will be steered from the top of this house, on which will stand the standard compass by which all above-water navigating will be done. Up there, practically beyond the influence of the great mass of metal within the vessel, the compass has been found remarkably true. A water-tight hatch leads down into the main body of the boat, and this will be sealed when the boat is submerged, at which time all of the navigating will be done from compartment A.

The New Argonaut is 66 feet long, has a beam of 10 feet, and weighs 100 tons. Her air tanks, which are two big Mannesmann drawn-steel tubes, are proof to a pressure of 4000 pounds per square inch, and have a capacity amounting to a 48-hour supply without surface connections. Enough fuel, in the shape of gasoline, will be carried to ensure a radius of action of 1500 miles. She is propelled by two White & Middleton gasoline engines of 60 indicated horse-power, which not only drive the screw, but also turn the two forward wheels which grip the bottom when traveling submerged. The after wheel acts as a rudder, both when on the surface and when afloat. All the wheels have a perpendicular adjustment to meet the bottom conditions.

She will also have a small 4 indicated horse-power auxiliary engine for running the incandescent lamps, providing air circulation, and for driving the air compressor. She will also have a 3-kilowatt dynamo for running the search-lights at the bow. The sand pumps, which are placed on the deck—two abreast the pilot-house and one abaft—will get their power directly from the main engines, being coupled up at will. When engaged in wrecking or in laying submarine foundations, a derrick will be adjusted to the standard of the windlass, which runs down and fastens to the cylindrical body. The bowsprit is only a hydraulic buffer to guard against damage to the boat proper in case of collision above or below water.

Taking the compartments in turn, from forward, we have, first, A, from which the boat is managed when on the bottom. Here are also the search-lights, having four outlets, the one directly ahead on top, the one directly ahead just below, and two lateral ones on the sides of this lower one. The lights have been found to yield a pretty wide zone of illumination, and one reaching far enough ahead to make navigation reasonably safe on the bottom.

Compartment B is the diver's room. Here the air is let in from the compressor till it equals the pressure of the water without; this is determined by a pet cock in the manhole plate. When the pressure has been neutralized the door is dropped, and the diver steps down and out on the rungs worked on the inner surface of the door. It has been found that the air pressure converts this room into a great sounding chamber, and messages either from the diver or to the other members remaining in the ship can be heard without recourse to the telephone receiver. Compartment C is an air lock, by which intercourse may be had with the after-body of the ship without affecting the pressure in the diver's room. Compartment D is the living space, within which there are bunks for eight persons and lockers for their effects. Compartment E, operating-room, where are the air compressors, some of the pumps, and the registers for air and water pressures, and for depths and heel. Compartment F is the cook-room. Compartment G is the engine-room, and is too far aft to affect the comfort of the living space. Water ballast is carried in the bottom below the living and working spaces. The midship section of the keel is detachable, weighs three tons, and will be released only in case of accident. The two anchors, which are drawn into the body of the vessel by power-armed drums, have a combined weight of nearly two tons. When the vessel is to go from the top to the bottom these anchors are lowered, water is pumped into the double bottom until the buoyancy of the craft is less than the weight of the anchors. Then the wire cables are wound in over the drums, and the boat is slowly drawn down to the bottom. If she is to remain still, no more water ballast is taken in, but if she is to travel along the bottom her buoyancy is carefully reduced to suit the load the character of the bottom will stand, and the anchors are housed as before. This loss of buoyancy or pressure upon the bottom varies all the way from a few pounds to a couple of tons, just as the soil and the currents may require. In the body of the boat there are two rectangular side or dead-lights on each side, but they are of no use save to let in light when near the surface. Hand pumps are fitted as an emergency precaution in case of breakdown in the others. The vessel will be able to make quite six knots even on a muddy bottom—the older boat made five—while on the surface she should do eight. The commercial ends to which the New Argonaut will be put will be in laying submarine foundations, recovering treasure from well-known wrecks, finding sponge beds, coral formations and pearl fisheries in the West Indies. The powerful sand pumps make subaqueous excavation a matter of ease.

The military or naval use in either mining or countermining waterways is easily apparent, while with a few additional features it is easy to convert her into a submarine torpedo-boat of an offensive character. She can be held at any desired depth between the surface and the bottom, and the moral effect of the suspected presence of such a craft is not hard to imagine.

All that is claimed for this boat has been claimed before for other boats of the kind, and the promise has not been fulfilled. Perhaps the new boat is to prove the exception. We shall see.—*The Engineer.*

A commission has just been appointed by the French Prefect of Marine for the purpose of carrying out experiments with the submarine navigation of a new type of boat specially constructed by the inventor, Goubet. The boat in question, which is quite different from the first submarine boat, the Goubet, arrived by rail at Toulon on Wednesday morning of last week, and was at once taken to the arsenal. Its form is very striking. Almost spherical in shape, it is about 3 meters in depth, 3 meters in beam, and 4 meters in length. It is propelled by a screw with a diameter of 80 centimeters, and two fins or rudders are placed port and starboard for manœuvring the boat when it is submerged.—*The Engineer.*

FRENCH SUBMARINE BOATS.

The flotilla of submarine boats in France promises to present as great a variety of types as the battleships. After the enthusiasm following upon the performances of the Gustave Zede had simmered down, and people began to look at it from a more practical standpoint, it was recognized that its small range of action was calculated to lessen considerably its utility as a war engine. The new vessel, it was said, had at any rate proved the practicability of the submarine boat, and in the hope of getting something better the naval authorities gave fresh attention to the somewhat despised Goubet boat. This vessel, however, showed a tendency to dive to the bottom and stay there, and the naval experts begin to pin their faith in boats of the Morse type. Recent trials with the Morse submarine showed that as regards the range of action it had scarcely any advantage over the Gustave Zede, and it had to be admitted that the boat could not be used for any other purpose than harbor defense. After all these experiments, however, it did not seem as if much headway had been made, but the naval department, with praiseworthy optimism conveyed its favors to the Narval, simply because absolutely nothing was known as to the behaviour of this type of vessel, and plenty of scope was consequently allowed for the exercise of a vivid imagination. The Narval has been constructed upon the plans of M. Laubeuf, a naval engineer, who secured the gold medal in the competition for submarine-boat projects organized by M. Lockroy. She was put upon the stocks at Cherbourg in July, 1898. Constructed of steel, she has a length of 34 m., a width of 3.75 m., and draws 1.60 m. of water when navigating at the surface. Her displacement is 160 tons. The motive power is supplied by a Forest oil engine, which not only drives the propeller when the boat is either navigating at the surface or with only her look-out and chimney exposed, but also operates a dynamo for charging batteries of accumulators, these being used to propel the boat when she is entirely submerged and the chimney unshipped. Sailing at the surface at 12 knots, the Narval promises a range of action of 252 miles, and at eight knots the range is to be 624 miles. When submerged the accumulators will propel the boat twenty-five miles at eight knots, and seventy miles at five knots. The Narval is equipped with four torpedo-tubes, and carries two officers and nine men. The boat was launched at Cherbourg last week, and the greatest interest is being taken on the other side of the Channel in her forthcoming trials, and it is this type of vessel which carries the hopes of France.—*The Engineer.*

THE IMPROVED GOUBET SUBMARINE TORPEDO-BOAT.

Of the many men who have endeavored to invent a practicable submarine boat, says Stein der Weisen, the French engineer, Goubet, seems to have been most successful in solving the problem of keeping the submerged vessel in equilibrium.

The apparatus by which this is accomplished is automatic in its operation, and is constructed on the principle of the balance. As the boat inclines from an even keel a double-acting pump is made to discharge water from a reservoir in the stern to another reservoir in the bow, or vice versa. The receptacles hence resemble the hands of a balance, and the weights represented by the water are shifted from one pan to another. The pumping of the water from one tank to the other is effected so rapidly that the vessel is almost immediately returned to an even keel.

The length of the boat is 8 meters (26.24 feet). The motive power is derived from accumulator batteries of sufficient capacity to drive the boat for fourteen hours. Enough compressed air is carried to supply the crew of two men with fresh air for eight hours. The screw of the boat is so arranged that it can be adjusted to all sides. The usual rudder is hence dispensed with. The boat, by reason of its adjustable screw, can be directed not only to the right or to the left, but upward or downward. At the stern of the boat a torpedo-tube is mounted by means of which a torpedo can be discharged upwardly against the bottom of a vessel, where it is exploded electrically from the boat. The vessel is also provided at its nose with a device by means of which the cables of harbor mines can be cut. The light necessary for this operation is provided by an electric light mounted in the nose.

This boat is known as the Goubet I. The inventor has, however, made various improvements which he has embodied in a new vessel called the Goubet II. In the later boat access is had to the interior by means of a ladder which is removed before the dome is closed. The cover for the dome is rendered water-tight by a rubber packing. In the Goubet I there was so little room that the two men who composed the crew were compelled to sit back to back in the center of the boat; the Goubet II is much roomier. The commander takes his position amidships in a revolving chair, so that he can see in every direction through the dome. His two assistants have charge of certain apparatus and are stationed at the ends of the boat with their faces turned to the center. The man at the bow manipulates two levers, by means of which the valves of the water ballast are controlled. Behind his head is a tube in which a receptacle inclosing messages is placed; the vessel having a specific gravity less than that of water will rise to the surface to be received by friends above.

The electric motor is located in the stern and is driven by batteries placed beneath the deck timbers. Above the motor is a hand-wheel by means of which the screw propeller can be moved to any position. The tubes are located at each side of the vessel. An apparatus is also provided for releasing the leaden keel in order to enable the boat to rise rapidly.

Ordinarily the Goubet II travels partially submerged on the surface, so that only its dome is visible. When near a hostile vessel the Goubet is sunk to a depth of 4 or 5 meters, or if necessary to a depth of 10 meters. When submerged the lookout can see nothing through the dome; for which reason a periscope is used when the depths are not great. It is of the utmost importance to maintain the vessel so far as possible at a constant depth. This is effected by an ingenious automatically operating apparatus comprising essentially a gage which indicates the water pressure and thus the depth at which the boat may happen to be. As the finger of the gage travels over a contact arc it breaks or completes an electric circuit and thus controls the water ballast pump.

The motor of the Goubet II is of 2 to 3 indicated horse-power. In the latest type of vessel mercury sulphate batteries are used instead of accumulators, because the latter generate hydrogen gas which forms an explosive compound with air.

As the air in the interior of the vessel becomes vitiated by the breathing of the crew, it is pumped out of the boat, while fresh air from the compressed air supply is allowed to take its place. Carbon dioxide gas is absorbed by potash; while the moisture and organic products breathed out are absorbed by calcium chloride. Under these conditions the boat can remain under water for from ten to fifteen hours.—*Scientific American Supplement.*

SUCCESSFUL TRIALS OF THE HOLLAND SUBMARINE BOAT.

The naval board appointed to inspect and report on the performance of the Holland submarine boat has reported that in the recent tests, held on November 6, in New York harbor, she fulfilled all the requirements laid down by the department. These requirements were that she should have three torpedoes in place in the boat, she should have all arrangements for charging torpedoes without delay, and that she should be prepared to fire a torpedo at full speed both when submerged and at the surface. Lastly, the Holland was to make a run for two miles under water, starting from one buoy, running submerged for a mile to a second buoy, rising to discharge a torpedo at a mark near the second buoy, and then after diving again return submerged to the starting point.

In his report, Chief Engineer John Lowe, U. S. N., who was specially ordered to observe and report the preliminary trials, says:

"I report my belief, after full examination, that the Holland is a successful and veritable submarine torpedo-boat, capable of making a veritable attack upon the enemy unseen and undetectable, and that, therefore, she is an engine of warfare of terrible potency which the government must necessarily adopt into its service."

He further says that "this government should at once purchase the Holland and not let the secrets of the invention get out of the United States, and that the government ought to create a submarine torpedo-boat station for the purpose of practice and drilling of crews, and that we need right off and right now fifty submarine torpedo vessels in Long

Island Sound to protect New York, preserve the peace, and to give potency to our diplomacy."

While we cannot agree with Mr. Lowe in his opinion that we need and presumably should build a whole fleet of torpedo-boats "right off and right now," we do think that the Plunger, a larger boat of the Holland type now building for the government, should be immediately completed and further trials of the system carried out.—*Scientific American.*

TORPEDO DISCHARGE BELOW WATER.[1]

By CAPTAIN LLOYD, late Royal Navy.

The author commences by referring to the modern form of Whitehead torpedo, and gives a brief account of the part it had played in naval warfare since its invention. Owing to the objections raised against above-water discharge, it has at last been recognized that nothing lies between abolishing the use of the torpedo from large vessels and the adoption of discharge below water-line.

The problem of ejecting the torpedo from the broadside below water is a very difficult one, for then the stream of water, passing at right angles to the direction of ejection, has to be contended with. No apparatus would be considered satisfactory unless ejection could be carried out at a high speed of ship, say 17 knots, and calculations had shown that at that speed the stream of water impinging on a cylindrical surface would impose a pressure of 634 pounds per square foot of sectional (longitudinal) area, or in the case of an ordinary Whitehead torpedo, a total pressure of 5.2 tons. The principle on which almost all submerged discharge apparatus has been designed, is to rig out a shield which is also sometimes called a spoon, sometimes a bar. There are grooves of some form in this shield, and guides on the torpedo, which fit into the grooves. In this way the torpedo is supported against the streams of passing water, and guided so that its axis remains coincident with the axis of the submerged tube, until the tail of the torpedo is clear of the ship's side. In fact, the shield is made of such length that the guides on the torpedo run out of the grooves in the shield at the same moment, or shortly after the tail clears. Whilst the torpedo is traveling along the shield, the head or the part in front of the guides will become more and more exposed to pressure from the passing water, whilst the tail or part in rear of the guides will always be more or less protected from pressure by the shield. One point to be observed in designing the shield is to arrange it so that the streams of water may pass through it as much as possible, and by exerting pressure on the rear part of the torpedo, do something towards balancing the pressure or weight on the front part. Much can also be done in this direction by placing the guides as far forward along the torpedo as possible. But there must always be a want of equilibrium, and this must cause a certain amount of deflection. If, however, the deflection is constant, and is known, it should not cause bad practice. It is a curious fact, revealed and confirmed by practice, that the deflection is constant for all speeds, nor does this deflection appear to be influenced by the angle of the tube to the ship's keel.

In the Elswick apparatus the shield or spoon is a cylinder with the after side removed. The front side is perforated as much as possible with

[1] A paper read before the British Association.

ports so as to allow the water streams to pass through and help to balance the pressure of water on the torpedo. The shield is provided with double grooves on the top and bottom, to guide the torpedo. For the ejection of a torpedo three distinct operations take place: 1. The shield to be run out. 2. The torpedo ejected. 3. The shield withdrawn. If these operations be done separately, either a ship must go into action with the shield already out, or there must be delay to be allowed for, before firing. In the Elswick apparatus all three operations are combined. If the shield or spoon, and the torpedo be ejected actually together, the two motions being independent of each other, there may always be the risk of some cause impeding the shield, while the torpedo pursues its course. The torpedo guides would, under such circumstances, leave the grooves in the shield before the latter was entirely out, and the torpedo would certainly be injured or deflected abnormally. In the Elswick design, for the two actions, those of running out the shield, and ejecting the torpedo, are dependent one on the other. After the torpedo has gone, the pressure which ejected it is allowed to escape and the head of water forces back the spoon. The apparatus consists of two principal parts, the inner tube and the outer tube. The inner tube is made in two parts, the shield or spoon, and the rear end, but these two parts are bolted together. The grooves to guide the torpedo run from one end to the other of the inner tube, on the top and bottom, and the rear end is closed by a door in which is fitted the axial valve for controlling the admission of pressure to the torpedo.

The outer tube encloses the inner tube. It is fitted at about half its length with a gland box through which the rear end of the inner tube passes. The front end of the outer tube is attached to the sluice valve casing, the rear end is fitted with a door, and on the top of the tube is placed the explosion chamber or air reservoir, or frequently both. The explosive preferred by the author's firm is cordite, which is quite clean, and is a slow-burning explosive. The cordite charge is ignited, causing a pressure of about 850 pounds to the square inch in the explosion chamber. The gases escaping from this chamber have to pass through a plate having in it a number of small perforations. The passage through these small holes insures that the pressure on the other side of the perforated plate does not exceed 100 pounds. Thus, while retaining a sufficiently high pressure in the explosion chamber to burn the cordite, there is a moderate pressure to set the inner tube in motion. The pressure falls to under 40 pounds by the time the tube has got out 6 feet. At this point a valve known as the axial valve opens and the pressure is communicated to the torpedo. The axial valve is fitted in the rear door of the inner tube and is loaded by a spring tending to keep it shut. It is locked or freed by a lever which travels in a groove cut in a plate attached to the outer tube, so that when the inner tube is right back the valve is firmly locked. When the tube has traveled rather more than a foot, the lever is slightly raised and the valve is allowed to open a very little, and when the tube has traveled 5 feet 6 inches the lever is lifted its full travel, these motions of the lever being controlled by undulations in the groove. The valve is thus unlocked, and the pressure at the back of it forces it open, and the final ejection of the torpedo from the inner tube takes place. After the departure of the torpedo the gases will escape by the axial valve until the pressure behind the tube equals the pressure due to the head of water plus the pressure exerted by the spring which loads the valve. This last load is 1 pound per square inch. If air impulse be used, and there was no other exit for the air but the axial valve, it is evident that the tube would not return. With cordite, however, the fall of pressure due to loss of heat soon assures the pressure behind the tube, tending to keep it out, being reduced below the pressure of the head of water tending to force it in. In any case, however, there must be a decided interval between the moment of opening the valve and the running in of the tube. During this interval the final ejection of the torpedo takes place, and the torpedo clears the spoon. The interval varies, but that is quite immaterial, providing that the torpedo clears before the tube commences to run in. The tubes are generally installed with their axes about 10 feet below the water-line. The pressure due to the head is therefore approximately 4½ pounds per square inch. The sectional area of the inner tube being 500 square inches, there is a total pressure of 1 ton to force the tube in, in opposition to the friction caused principally by the packing which surrounds the inner tube, and by the load imposed upon the bearing surfaces of the spoon by the passing streams of water. The rear end of the outer tube is fitted with three drain valves. These are supplied with springs tending to keep them open. The pressure employed during the ejection of the torpedo is, however, ample to close them. When that pressure is reduced after ejection of the torpedo, the springs open the drain valves, which then let the pressure, whether caused by compressed air or by cordite gases, escape, so that the pressure due to the head of water tending to force the tube in is unbalanced, and the tube returns. The drain valves, however, are small, and if the tube comes in too fast the pressure behind it cannot escape quickly enough, the drain valves close, and the motion of the tube is checked. Although the automatic return of the inner tube can be generally relied upon, it is apparently desirable to have some alternative method of running it back. Hand gear is, therefore, provided for this purpose.

A short discussion followed the reading of this paper. Mr. Mark Robinson pointed out that under-water discharge was known before, though the details mentioned by the author had been specially devised. Another speaker asked if any provision was made against deflection of the tube.

Sir William White said that the apparatus described by the author in his paper afforded a beautiful example of difficulties being overcome by mechanical arrangement. In regard to the perfectly true remark of Mr. Robinson, under-water discharge of the fish torpedoes was known in the navy 20 years ago, but Captain Lloyd doubtless did not wish to make any comparison between various systems, and simply related what had been done at Elswick. Perhaps it should be stated that before Captain Lloyd took up his present position with the Armstrong firm, he was a distinguished officer in the Royal Navy. Mr. C. A. Parsons asked what was the maximum speed of a ship at which a torpedo could be discharged with safety. Another speaker asked how the pressure was communicated to the torpedo.

In replying to the discussion, Captain Lloyd stated that by means of an axial valve, which is situated at the rear end of the inner tube, the pressure impinges on the torpedo at the proper instant, so that it is shot out by the gases of explosion at the moment. It may here be explained that the outer tube is a fixture attached to the ship's side, the outer end having a valve by the opening of which the torpedo can be ejected. Inside the outer tube the inner tube slides telescopically, and inside the inner tube the torpedo is placed. When the inner tube is slid back, and the sluice valve in the ship's side is closed, so as to prevent access of water, a door at the rear end of the tube is opened and the torpedo inserted after the manner of a projectile in a breech-loading gun. The torpedo is now inside the inner tube of the telescope, and the door which is in the rear of that tube contains the axial valve. The cartridge is placed in the outer tube, and when fired it forces the inner tube out, and with it the spoon or guide. At a given distance of travel the axial valve opens and admits pressure behind the torpedo, which is thus sent on its course. The pressure due to the head of water outside the ship then pushes the tube back, and the sluice valve can be closed. In regard to the deflection of the inner tube, the author said it would be understood that this was immensely strong, but however stiff they might try to make it, it would bend a little owing to the pressure of the water upon it. They therefore, in making it, gave it a slight bend the wrong way, so that when pressure was brought upon it, it would tend to straighten. There were three guides on the torpedo, and if the tube were too much bent the middle guide would not engage. This would throw too much stress on the guide at the tail, and the after part was that which was most delicate, and therefore should not be strained. In regard to speed, they had fired a large number of rounds at 17 knots with safety. In the Brazilian Navy—and he mentioned this more especially because some people in this country seemed to think that the Brazilians were not very enterprising—a large number of experiments had been carried out with complete success.—*Engineering.*

THE PROGRESS OF THE AMERICAN NAVY.

The full strength of the navy of the United States now amounts to 312 vessels of all kinds, built and building. Of this number 189 are in the regular navy and 123 constitute the auxiliary force, for the accumulation of which we are largely indebted to the necessities of the Spanish-American war. Something of the pace at which we are moving forward may be imagined when it is stated that roughly estimated the existing naval fleet represents an expenditure for construction of about 125,000,000 dollars, and yet there are now under construction or awaiting formal acceptance by the government more than half a hundred war vessels, the contract price for which, exclusive of armor and armament, is in the neighborhood of 40,000,000 dollars. The war almost doubled the aggregate of men on our war vessels. At the outset the complement was 12,500 men, but in the summer of 1898 it reached the maximum figure of 24,123 men. Since that time it has, of course, decreased considerably, but the incoming Congress is expected to authorize a permanent naval strength of upwards of 20,000 men. Nor, in passing, should mention be omitted of the success which has attended the amalgamation of the line and staff. An experiment watched by students of naval administration everywhere, its beneficial effects have been discernible instantaneously.

For the future, bright hopes may be based upon the most favorable of indications. Congressmen have been spending the summer of 1899 in the study of naval science abroad. Places on the naval committee have been eagerly sought. Already a new atmosphere of liberality and intelligence characterizes the consideration of naval problems and affords ground for hope that never again will the march of progress be retarded by such a lack of knowledge as made possible the late fiasco relative to the limitation of armor prices. New battleships, armored and protected cruisers are to be constructed. Each class is quite certain to mark a step forward in the science of building vessels of war. Rear-Admiral George W. Melville declares to the *Review* that the new battleships should be of 20 knots speed; that they should carry large batteries of rapid-fire guns; have ample coal-bunker capacity, and be fitted with triple screws—radical revolutionary measures, all, but vital in influence if successful. Already the eyes of every naval officer across the Atlantic are upon us. Within the past month two of our new battleships have exceeded contract speed. The practicability of that most novel of ideas—the superimposed turrets of the Kearsarge—will soon be put to the test. We are preparing to outdo the British in the thoroughness of our experiments with liquid fuel and wireless telegraphy. Finally we are investigating the possibilities of the submarine boat and our conclusions will have enhanced value because they will be characterized by neither the enthusiastic optimism of the French or the cynicism of the conservative Britons. For well-rounded naval development every essential must be adequate. Thus there is no greater cause for congratulation than over the manner in which the shipyards of America have met the requirements imposed by new conditions. The past few years have seen no less than half a dozen firms actively engaged upon naval contracts, although their previous experience had been entirely confined to mercantile craft. Several of them, at the initial attempt, constructed vessels which exceeded contract speed.

Heretofore the powers have charged us with being deficient in the matter of diversity of strength in our naval fleet. This is true no longer, for with the completion of the vessels now on the stocks we will have more than half a hundred torpedo-boats and destroyers. Here, too, American builders have been daring, for who will contend that it is not venturesome to guarantee a speed in excess of 30 knots on a smaller displacement than has ever before been attempted by any shipbuilder the world over—and that, too, when the contract is the first of the torpedo-boat kind for the firm undertaking it? Even down to the details the United States Navy will be unique. No other nation has found so appropriate a form of designation for its fighting craft. Our states have given us names for two dozen; two score of our cities have namesakes in our navy, and finally no less than thirty of our naval heroes have had their names commemorated by war vessels. It is a novel navy and a magnificent one, and with its strength considered, it is the most interesting on the waters of the earth.—*Marine Review.*

A SIX-MASTED SCHOONER.

Mr. H. M. Bean, at Camden, Me., is building a six-masted schooner, which will register about 2750 net tons, and will carry from 5000 to 5500 tons of coal. Thirty years ago the average schooner built in this part of the world was of from 100 to 250 tons register. Then, along in the early seventies they began to build three-masters slightly larger, and the size was increased gradually to about 500 or 600 tons in 1880. In the eighties there was a demand for larger vessels for the coasting trade, and the size of the three-masters went up to from 600 to 900 tons, with a coal-carrying capacity of from 1000 to 1400 tons. Late in the eighties a few four-masters were built, and then, in 1888, at Waldoboro, was launched the first five-master, the Gov. Ames, of 1689 tons net. This vessel was the wonder of her time, and it was predicted that she would prove a lamentable failure. She has been a great success, however, and not alone in coasting, for she has been around the Horn to the Pacific and back again, carrying 1,650,000 feet of Oregon pine to Liverpool, besides making several voyages from Puget Sound to Port Pirie, Australia. In recent years several four-masters have been built that are larger than the Gov. Ames, among them the Frank A. Palmer, of Bath, of 1832 tons, now on the way to Tampa, Fla., with a cargo of stone for the fortifications there. The latest wonders in the big schooner line are the John B. Prescott, built at Camden, and Nathaniel T. Palmer, built at Bath, both launched last winter. These vessels are of the five-master type, each registering about 2245 tons and carrying from 4000 to 4400 tons of coal, according to weather, voyage and draught. Two five-masters of less tonnage have since been launched at Bath. The new six-masted schooner being constructed at Camden will be 310 feet in length on the keel, 345 feet on deck, and will carry 5500 tons of coal on a draught of 24 feet. It is interesting to roughly estimate the earnings of a vessel of this class. As shown by the records of other schooners, there is a possibility of this vessel's making 18 trips a year. Some of the big schooners in the coal trade average over 20 cargoes a year. At 18 cargoes the schooner will carry 99,000 tons of coal in a year. Averaging 70 cents per ton, trimming included, the gross earnings for a year would be $69,300, 70 per cent. on the original investment. The two bills on such a vessel would average $6000 a year, the wages of the officers and crew $7000, food bills $3000, water and coal $500, incidentals, allowing for renewal of running rigging and for bursted sails and repairs, $5000, making a total of $21,500, leaving a profit of $47,800, or over 47 per cent. Insurance on vessels averages about 7 per cent., and there would be left a net profit of better than 40 per cent. This is what such a vessel might do with extra good luck. Under the most adverse circumstances she would not make less than 12 trips a year, and would even then pay 27 per cent.—*Nautical Gazette, N. Y.*

AMERICAN SHIPPING AND SHIPBUILDING.

As the time for the assembling of the United States Congress approaches speculation is quickened as to the course which will be adopted with regard to shipping. Our own belief is that we are on the eve of a vast and severe competition for our well-earned supremacy as shipbuilders and sea-carriers. Those who have followed the course of the shipping subsidy movement in the United States, and who know the conditions of politics in that country, cannot but be impressed with the significance of the portents. There is a world of meaning in the fact that Mr. T. B. Reed will not occupy the Speaker's chair in the new Congress, for it was really Mr. Reed who blocked the last shipping subsidies bill in the House. This is a little difficult for those to understand who think of the chairman of the American House of Representatives as an impartial instrument of authority, and nothing more—like our own Speaker of the House of Commons. But unlike him, the American speaker is the leader of the party which is in a majority in the House. He not only orders the method of procedure of his party, but as chairman of the committee on rules, he arranges the order of all the business of the House. When he does not wish a measure to pass he can so arrange the order of business as to block it. And this is what Speaker Reed did with the shipping subsidies bill, which he regarded as a measure that might well wait for a more convenient season. Not Mr. Reed, however, but the nominee of Mr. Hanna, will occupy the speaker's chair in the new House. And we have to remember in this connection that Senator Hanna introduced the shipping bill that was adopted by the Senate, after it had been amended by Senator Frye; and that the Republicans—of which Mr. Hanna is boss—have an absolute majority in both houses.

We may take it, then, that if a shipping subsidies bill is reintroduced as a party measure, it will surely pass into law in the coming session. And that such a bill will be introduced there is not room to doubt. Our information is that it is already drafted, with the hearty approval of the party leaders, and we have reason to believe that the prospects are regarded with serious misgiving by some of our leading shipowners. The new bill will probably be a modification of the Hanna-Frye bill. The immediate object in view is the re-creation of an American mercantile marine, but that object can only be attained, in the peculiar conditions of politics and "interests" in America, by the fostering of an American shipbuilding industry on a great scale. There is no doubt a growing feeling of opposition to, and fear of, the great monopolies that have grown up under the tariff, but there is also a very widespread desire that the United States should have a merchant navy again worthy of her importance, and that as soon as possible. The original subsidies bill of last session was bluntly enough denounced as one of the biggest jobs ever placed before Congress; but the Frye amendments brought the "job" within limits by providing that the treasury should spend on subsidies no more than nine million dollars in any one fiscal year. And it is expected that the new bill will considerably enlarge the first section of the Frye bill, under which half bounties were to be payable on foreign-built ships admitted to the American register, provided the owners engage to build a similar amount of tonnage in the United States within five years. For the encouragement of shipping, the expansion of which is in turn to encourage shipbuilding, it is expected that the new bill will admit to full bounty privileges all foreign-built vessels acquired or contracted for by Americans prior to the passing of the act. And it is in anticipation of this provision that conditional contracts have been placed by Americans with British shipbuilders, as was referred to in our shipbuilding article recently.

But it is not realized in this country how much iron shipbuilding has already developed in the United States under the stimulus of the war, and of the prospective certainty of some such measure as the Frye bill being soon passed into law. Of course we all know how America took the lead in the good old days of wooden clippers, but all do not know how vigorous an infant now is the iron shipbuilding industry there. The government building yards have grown enormously since the United States began, in 1884, to build her own warships. At that time there were only three establishments for building iron vessels in the whole Union, and there were only four American-built ocean steamers of iron afloat. At the present time there are between forty and fifty steel vessels of various classes in process of construction for the United States Navy, in no fewer than sixteen different yards, of which three are on the Pacific coast. These vessels range from first-class battleships to small torpedo-boats, and all the material till now has been of American manufacture, though of late some purchases have had to be made in Great Britain, owing to some of the American producers not being able to deliver in time to meet the requirements of the naval contracts. The American official returns are difficult to compare with our own, because the American fiscal year ends at June 30th; but in the last fiscal year the amount of steel tonnage alone built in the States was 134,000 tons. In the present fiscal year that tonnage will be at least doubled, and may reach 300,000 tons. Now this means both great and rapid development. Besides the naval work we have mentioned, every shipyard in the country is reported to be full of merchant work, and is extending its area. At Camden, Delaware, is being put up an entirely new establishment, which when complete will rank as the largest building yard on the Atlantic coast. This new yard will cover an area of 125 acres; it will be adapted for the building of first-class warships of the largest size; and it will have a graving dock 800 feet long for the reception of ocean liners, of which a specialty is to be made.

All the Atlantic shipyards are now engaged on naval construction work, as well as the repair work at the three government yards at Norfolk, Va., Philadelphia and Brooklyn. The Norfolk yard is an old establishment, dating back to the days of wooden frigates, and during the civil war it was the object of severe contention between the rival forces. It has been reconstructed on modern lines, and is now adapted to the construction and repair of warships of the latest type, though it has not been able to make much of some of the damaged vessels captured from the Spaniards. The Norfolk yard is, however, chiefly used for repair purposes; and, indeed, there has been comparatively little building in any of the government yards of late years, Congress seeming to prefer to encourage private enterprise by letting out all new work on contract. There is little doubt that this has had material effect in attracting capital to, and stimulating development in, the shipbuilding industry within the last year or two; and it is to be remembered that the private yards are not subject to the wage and labor conditions applied by Congress to the government establishments, though an effort was made last Congress to make them applicable to all government work, wherever done. The Philadelphia—League Island—yard has also been used almost exclusively for repairs, but it is declared to be an ideal place for building, and will be so utilized in the future. At the Brooklyn yard are the largest dry docks in the country, though at League Island a still larger one is in course of construction under a vote of last Congress.

Meanwhile, however, all the additions to the United States Navy are being made by private builders under government inspection, and fifty vessels of all sorts is a large order. Pending the completion of the Camden yard, the largest shipbuilding establishments now in operation are those of the Newport News Shipbuilding Company, Virginia; of the Cramp Company at Philadelphia; and of the Harlan-Hollingsworth Company at Wilmington. But another large yard is being brought into operation on the Pacific coast at Seattle, in the State of Washington, for the building of steamers for the Pacific trade. The obstacle to the development on the Pacific coast is, of course, the long carriage on material, the nearest base of supply for which is Chicago. Notwithstanding this difficulty, shipbuilding is developing steadily there. Two battleships are now being built in the San Francisco yard which turned out the famous Oregon, and which has also built warships for Japan. A large fleet of merchant vessels is wanted for the Pacific, and it is found cheaper to build them of deported material on the Pacific coast than to build them on the Atlantic and send the ships round Cape Horn. At San Francisco, as well as at the new yards at Seattle, quite a number of high-class large ocean steamers for the Pacific trade are being built—the largest merchant steamers, we believe, as yet built in the States.

The United States Commissioner of Navigation recently estimated, whilst gathering material for his annual report, that not fewer than 1000 vessels were added to the American register during the last fiscal year, including, of course, vessels purchased from foreigners and vessels intended for the inland waters only. We cannot yet tell how much of that tonnage comes into the ocean-carrying trade. But the Commissioner of Navigation has prepared tables to show the effect which the proposed shipping legislation will have upon shipping, on the assumption that the subsidies will merely "offset" the higher cost of construction and operation in the United States. He also regards the subsidies as an "offset" to payments under British mail contracts, which is a fallacy, for under our mail contracts we merely pay for services rendered—that is to say, the so-called mail subsidies are just freightage for goods carried. Of more importance, to our mind, than the subsidies proposed by Senator Hanna is the fact that the cost of production of iron and steel in the future promises to be considerably lower in the United States than in this country. We do not refer to present conditions, which are abnormal, but to the conditions which will prevail when the present excitement has abated.—*The Statist.*

THE POSSIBILITIES OF LIQUID AIR.

By Elihu Thomson.

At the outset it must be understood that in dealing with the present subject the writer does not wish it to be inferred that what he calls possibilities are, in his judgment, probabilities of the near future, or, that we are upon the eve of any great revolution in engineering methods as the outcome of the recent laboratory studies of liquid air. Much further study and much additional data are required before anything more than mere suggestion can be made in this fascinating field; for, say what we may, the subject possesses an attraction for those who are accustomed to look ahead, remembering that the laboratory experiments of one day and generation have often in the past become the foundations of great industries. It took three-quarters of a century for Davy's electric arc to develop into the beginnings of commercial arc-lighting, and nearly fifty years elapsed after Faraday's brilliant researches in magneto-electricity before dynamos became a part of engineering. Yet Faraday had built a primitive dynamo and its reversed form was known in primitive types of electric motor.

The object of the present article will be to suggest, rather than predict, directions in which, under certain conditions, liquid air may possibly become a factor in engineering. And in the absence of favorable conditions need it be said that such possibilities will *not* be capable of realization?

Let us assume the availability of some innocuous gas liquefiable at about one hundred atmospheres pressure, at temperatures easily and cheaply attained, and at no cost for the gas itself. In such a case there can be no doubt of its soon finding enormous application in the storage and recovery of energy. Cheap power would be used to compress and liquefy it, after which it would be stored in quantity, either in atmospheric pressure or at some selected higher pressure. Such a liquefied gas would be stable, or remain in a liquid state, if heat were prevented from reaching it. This could be done, not perfectly of course, by surrounding the containing vessel with a liberal thickness of some good non-conductor of heat. That part of the gas which would inevitably escape on account of the lack of perfect heat-insulation would be cold and would be made to reverse the non-conducting covering in successive layers from within outward, and thus assist in cooling the covering and in preventing access of heat to the liquid; or, the escaping gas might even be made available for power in an engine, if the liquid were kept under a proper working-pressure. In this case further heating of the gas, analogous to super-heating of steam, could be employed before sending it to the engine. But little of the energy of the heat so added would be lost, and a considerable part of it could be supplied by the surrounding air or by water.

With such a liquefied gas produced at one place by cheap power and carried to another for evaporation and recovery of power, ice could be made as a by-product.

In many plants used for the development of power on a large scale, a twenty-four hours' output is not called for, but could be attained at but slight additional expense. The excess power from such a plant needs some means of utilization. This excess power, as during periods of otherwise light load, could be employed to liquefy the assumed gas. On a large scale this procedure would not be costly, supposing use of highly developed machinery. The liquid product could then be transported in tanks provided with heavy lagging and special arrangements to prevent access of heat from the outside. Perhaps it could be distributed by a well-covered pipe-line. The unavoidable evaporation which would be involved in the pipe-line transportation might not be altogether a loss, for if the line be under a pressure suitable for engines the escaping gas might possibly be tapped out at intervals, heated, and used for power along the line of way.

But the foregoing considerations are based upon the existence of a gas at no cost, with desirable properties rendering its liquefaction easy. Such a gas does not in fact exist. There then arises the question whether we can render available any of the gas known to us. Carbonic acid gas is cheap, but still far too costly for use in the way proposed. It would not pay to send it back long distances for recompressure and reliquefaction. It costs too much to be thrown away after it has been once used.

The air itself meets the condition at no cost for material in the case. We owe much the larger part of our present knowledge of the properties of liquid air to a brilliant series of investigations undertaken some years ago by Professor Dewar at the Royal Institution in London, and continued later by Professors Dewar and Fleming conjointly. The effects of the exceedingly low temperature attained by the evaporation of liquid air, upon electric conductors, dielectrics, electrolytes, etc., have been carefully studied by them. Few are able to appreciate the labor and painstaking effort that must have been expended on these researches.

In culmination, Professor Dewar has indeed lately succeeded in reducing even hydrogen to a liquid and in collecting quantities of it. Temperatures not far removed from absolute zero (—273 degs. C.) are obtained by the evaporation of liquid hydrogen. But the absolute zero, like the dynamo of 100 per cent. efficiency, may by each advance be more and more closely approximated but never reached. This low-temperature research has shown that at temperatures as low as —200 degs. C., attainable by evaporation of liquid air, conducting metals, as copper, platinum, silver, etc., when in a very pure state, have their conductivities so much enhanced that electric currents flow with but a fraction of the resistance experienced at ordinary temperatures. Research has shown that at absolute zero they would become perfect conductors. Professors Dewar and Fleming also found that liquid air is a very perfect insulator, and that ice and many frozen electrolytes even become excellent insulators at the temperatures of liquid air; and in general that intense cold in insulators improves the insulation, just as it improves the conductivity of conducting metals when they are pure.

Unfortunately, however, the liquefaction of air requires rather extreme conditions, and in the early work of Dewar was an exceedingly costly process.

The discovery of the fact that air compressed, cooled and collected in a reservoir at from 100 to 150 atmospheres might be made to liquefy a portion of its own volume, rendered possible the procuring of liquid air by a more direct and simple means. The discovery is claimed by several persons, the merits of whose claims will not be here discussed. When highly compressed air escapes from a suitable orifice it is cooled by its own expansion. If the cooled air be now caused to circulate around a long coiled pipe, which brings the compressed air to the jet in such a way that the position of the pipe nearest the jet is the first to be met by the cooled air, and so back progressively from the jet; further, if the whole be thoroughly jacketed by a non-conducting covering, the temperature of the jet soon falls sufficiently low to cause liquefaction of a portion of the air even at ordinary atmospheric pressure. The operation itself is cumulative or self-intensifying, since the cooling due to expansion is employed, on the regenerator principle, to cool most effectively the compressed gas on its way to the jet and ready to expand.

If air be compressed to about 800 atmospheres it may be made to occupy the same space as it does when liquefied, but even at the higher pressures it would remain gaseous. Ordinary temperatures of the surrounding air are far above the critical temperatures of the gases composing it. In order that it may liquefy, it must lose kinetic energy, or be cooled; velocity of the moving molecules must be brought down. The removal of heat is essential, and the process of liquefaction can only be carried on by cooling the gas during or after compression. Conversely, liquid air confined in a closed and filled receptacle, when allowed to regain the heat lost in being liquefied, would become gaseous and exert a pressure of about six tons per square inch.

That the processes for producing liquid air will be developed so as to reduce the cost to an extent such as to render it available in place of a more ideal gas would be a vain prediction to make at present.

Liquid air consists chiefly of a mixture of four parts of nitrogen to one of oxygen. The presence of the oxygen is a disadvantage, inasmuch as fierce combustion, if not explosion, may be occasioned by bringing the liquid air into contact with combustibles in presence of a spark of fire. Fine cotton fiber and such like substances soaked in liquid oxygen are highly explosive. It is easy, however, to separate the oxygen from the nitrogen by fractional distillation at low temperatures, or methods may be employed to condense the oxygen separately from the nitrogen. Doubtless, oxygen gas so separated from its companion would have a value in chemical and metallurgical processes. The remaining nitrogen liquefied would be perfectly safe. Can it be transported?

The fact that a three-gallon milk-can of liquid air was brought by Mr. Tripler, of New York, from that city to Lynn, Mass., a journey occupying nine hours, and that not more than one-third of the liquefied gas was lost, although the only covering for heat insulation was about 2½ inches of ordinary steam-pipe felting, goes far toward indicating the possibility of transportation. With a tank of 20 times the linear dimensions of the milk-can referred to, the surface for loss of heat would rise to 400 times while the capacity would have increased 8000 times, and with no better lagging it is easily seen that the daily loss would then be not over 5 per cent. Doubtless, however, improved means for heat insulation would make the loss but a fraction of this amount. If the tank were kept under a pressure of say, 200 pounds to the square inch, a suitable safety-valve being provided to prevent excess of pressure, the evaporated gas or air could be made to do work, specially if superheated. If the tank were in a train the motive power might, at least in part, be derived from the normal evaporation from the tanks. Further, let us imagine a pipe-line well insulated for heat, and it is easy to see that if the velocity of flow equaled the train speed in the journey of the milk-can from New York to Lynn, the percentage loss in a pipe of the diameter of the milk-can with no better lagging than it possessed would be the same or even less. Here again perfection of heat insulation might make quite a saving, and the evaporated gas might, if the line were under pressure, be made available for power along the line of way.

Whether the liquefied gases of the air can be employed in this way will, however, depend upon the development of efficient methods of extracting the heat and effecting condensation of the air. That liquid air possesses no advantage for refrigeration is without doubt true, unless the refrigerating effect be obtainable as a by-product, so to speak, of energy conveyance.

Liquid air represents air compressed to about 800 atmospheres, but existing without pressure. No heavy and excessively strong tanks are needed for storing it. If it be pumped into a closed receptacle under regulated pressure it may be evaporated by the heat of the air, or that of surrounding objects, or it may receive heat from bodies undergoing refrigeration, as water being converted into ice; after which heating operation it may be further heated to the melting-point of lead by heat of combustion, and be finally used in a suitable engine where its expansion may develop power. During its expansion and delivery of power to the pistons of the engine it may become so cooled as to be discharged from the exhaust at nearly normal atmospheric temperature and pressure.

The power expended in compressing and liquefying air is, of course, converted into heat and thrown away. The product, liquid air, has no inherent power of energy in itself. It represents negativity, bearing somewhat the same relation that an exhausted globe does to the surrounding air. It may become the means for rendering the normal energy to the surrounding air available. Liquid air has capacity for taking up the ordinary heat of surrounding objects and thus acquiring pressure. It can be superheated very efficiently, and so used in the form of compressed air in an engine. The superheating will, of course, tend to raise greatly the total efficiency. The inevitable losses in the compressing and liquefying processes would in part be made up in the added heat, the amount of which is small and efficiently employed. We have no reliable data of large-scale operations, and can as yet reach no certainty as to the efficiency attainable in compression and liquefaction or in recovery of power. It is possible that the separation of oxygen, which would probably possess a value in metallurgy, might tend to diminish the cost of condensation. So also the refrigeration which is obtained during evaporation might help the recovery end. Where so much is "in the air" we must be content with suggestions only, and they may never be realized in practice. The power required to be expended in liquefying a given amount of air can be approximately estimated, and an assumed efficiency of plant may be made to do duty in place of exact figures where none are to be had, and if the conclusions based thereon are understood as tentative and subject to extensive modifications in view of further advances in our knowledge, no harm is done.

In making an estimate of the cost of liquid air as produced on the large scale, the factors of plant-efficiency, maintenance, etc., come in to a greater or less extent. Assuming that air be compressed as nearly isothermally as possible, and that in a large plant a possible total efficiency of 70 per cent. might probably be realized, each horse-power hour might thus be expected to compress nearly 10 pounds of air to a pressure of 2000 pounds to the square inch. If such compressed air, on being expanded in a very carefully arranged self-intensifying apparatus should condense 25 per cent. of the air admitted we would have about 2½ pounds of liquid air per horse-power hour. The assumed proportion, 25 per cent., seems not improbable in view of all the data—meager enough, it is true—which have come to the writer's knowledge.

If the power-cost be taken at $20 per year in large units and an additional charge of $10 be allowed for each horse-power of the compressing and condensing plant, its interest, maintenance and operating expenses, the cost per pound of liquid air would be about one-sixth of a cent, assuming the plant to run 7200 hours per year. This estimate, subject to modification from the very nature of the problem, would make the liquid air cost for production about 8 cents per cubic foot. If oxygen, separated by fractional distillation possessed a value for equal amounts in excess of the cost of the air the remaining nitrogen would, of course, be producible at a lower figure.

It is probably within the possibilities that a cubic foot of liquid air of nitrogen, if allowed to heat from its surroundings and then be further heated to 200 degs. C., could, in a high-pressure engine, yield about five horse-power hours. If at the same time the evaporation of the air were attended by useful refrigeration, as in making ice, the cost of recovery would diminish. Need it be said here, however, that even if the cost of horse-power of recovered energy much exceeded that which is indicated in the foregoing estimates or assumptions, a demand may still exist for a source of power having great compactness, freedom from nuisance, no heated nor noxious exhaust, and of unequalled controllability? The horseless vehicle problem certainly presents us with an instance in point.

It would seem, however, that certain uses may be found for liquid air in which considerations of cost are not so important as is the ability to obtain the effects in view. In warfare, for example, the possession of highly-concentrated energy-stores under control is very important. Liquid air can be rapidly converted into compressed air at six tons per square inch. This would probably be useful in the projection of high explosives. Compressed air is now used for propelling mobile torpedoes, or fish-torpedoes as they are called. Dirigible torpedoes either depend for power upon compressed air or the electric energy of a storage battery. Compressed air requires high pressures and very strong and heavy containing vessels. Liquid air can be stored without pressure or at low pressures, and can be evaporated at any desired pressure, while its bulk represents that of air under 800 atmospheres. A storage battery would probably be from five to ten times as heavy as liquid air in a receptacle, for equal available energy. But no storage battery could be discharged at an equivalent rate.

Submarine boats and flying-machines may yet find use for liquid air. In the submarine boat it could be evaporated by the heat of the surrounding water, and after furnishing power it would ventilate the boat. Before its final discharge it could be burnt with oil in a fuel engine for further power. We may find use for it in the flying-machine. For emergency work it could in evaporating cool the cylinders of a fuel engine and yield power as a result. Moreover, control of the submergence of a boat could be effected by the use of liquid air, so easily gasified, to add to the displacement.

The great feature of the application of such a power as liquid air would be its emergency value. By this is meant the ability to obtain at will a sudden output far beyond the normal. Animal power notably possesses this emergency value, and the success of electric trolley systems largely depends upon the fact that when needed, the station can be called upon for a temporary delivery to any single car or train, of a power greatly in excess of the rated output of the motor.

Suggestions have already been made of the use of liquid air or oxygen, mixed with the combustibles as a high explosive. Such an explosive can be made at the time of use, and if left unexploded, either by accident or design, soon loses its dangerous character by evaporation of the liquid gas.

Liquid air may also be used in the rapid production of high vacua. Let the bulb to be exhausted be filled with a gas, such as carbonic acid, more condensable than air, and be provided with an extension that can at any time be sealed off. If now the extension piece be immersed in liquid air the condensable gas will be taken from the bulb and deposited in the solid state in the extension piece. This is now sealed off, leaving a high vacuum in the bulb, particularly if the same be heated during the process.

A fascinating speculation for the electrical engineer is the possibilities of so cooling the conductors of electric lines or apparatus as to improve the conductivity many times, and so diminish the losses in any given length of conductor, and at the same time greatly improve the insulation. Professors Dewar and Fleming have shown, however, that it is a condition of this enormous improvement in conductivity that the metals be very pure, a very small percentage of impurity greatly lessening the result. As regards the insulation, they have shown that dielectrics and even electrolytes become insulators of excellent character when cooled to the temperature of liquid air. What effect such a lowering of temperature would have upon the dielectric strength or striking distance between conductors at differences of potential is not as yet determined, so far as the writer is aware. The result to be expected from a consideration of the effect of heating upon dielectric strength or striking distance is that very low temperature will make it far more difficult to break down insulation by sparking through it.

That the electrical engineer covets just such agencies as will thus extend the range of possibilities in his art needs no proof. He would be apt to choose a pipe-line conveying liquid air as the very best location for his conductors, assumed to be made of as pure metal as possible, the high insulation probably attainable being the chief object. Whether his conductors were placed outside such a pipe or within the same, he could no doubt adapt himself to the conditions provided he could get the benefit of the low-temperature insulation, and possibly, to a certain extent, a gain in conduction.

It is indeed very questionable whether a pipe-line will ever be laid and kept filled with liquid air solely for its electrical benefits, but if such a line were also used to supply liquid air to a distant point and the normal evaporation utilized, the case would be somewhat modified, though the improbability of such a combination being put into service, at least within any reasonable period, still remains.

It will be the proper attitude for the conservative and at the same time progressive engineer to await the possession of full and accurate data before drawing any conclusions as to future practice. Suggestions of possibilities are, of course, useful, even if only a fraction of them prove realizable, and no attempt is here made to do otherwise than call attention to matters which must from their nature possess more or less of interest.—*Engineering Magazine* (N. Y.).

THE PRACTICAL TRAINING OF ENGINEER STUDENTS.*

By Mr. Robert Mayston, R. N., Chief Engineer H. M. Dockyard, Devonport.

The engineer students are instructed both theoretically and practically to enable them to become engineer officers in the Royal Navy. For the last eleven years Keyham has been the only admiralty training ground for these officers. The number of students at the present time is 192. An entry is made once each year, during the first or second week in July, following a competitive examination held by the civil service commissioners in the previous April. The period of training is five years. Throughout this time they undergo an educational course at the Royal Naval Engineering College under Professor Worthington, whilst their practical training is obtained in the dockyard at Keyham, and the work they perform is as far as possible real. They take a considerable part in the repair and manufacture of machinery, and in the cases of the two ships which have formed the basis of this paper, they have had a very large interest, more so in the Psyche, for the reason that they have been

* The Institution of Mechanical Engineers at Plymouth. Part of the paper descriptive of the engines of H. M. S. S. Proserpine and Psyche is omitted.

able to follow the manufacture of her engines and boilers right through to the time of the ship going to sea, whereas in the Proserpine the engines and boilers were sent to Sheerness to be fitted in that ship, and the experience to be gained by seeing them fitted on board was not obtainable. As illustrating the part taken in the manufacture of new machinery, reference need only be made to that of the Psyche, and the following work was entirely carried out in the engineer students' fitting shop: The two surface condensers were tubed and tested; the two fire and bilge engines, eight fan engines, two hot-well engines and pumps, two circulating engines and pumps with auxiliary air pump, and the two reversing engines in connection with the slide-valve gear, were completely fitted up from the rough forgings and castings, including all machine and fitting work. In addition, a large number of minor fittings, such as cocks, valves, etc., passed through the hands of the students. It should be noted that the work just enumerated is an indication of what is performed by the students in the early part of their training, that is, during the first half of it, and its class is such as to offer every possible attraction for a student commencing a marine engineering career; at least, this is the object aimed at, and, judging by results, there is every reason to assume that it has been successfully attained. The workshops at Keyham are so close that the students are enabled to watch any erection of new machinery; in fact, it is part of their instruction to be shown the nature of the work as it progresses, and they are afforded every facility. It may be of interest to give the exact training an engineer student undergoes at Keyham during the five years he is under instruction preparatory to his appointment as an assistant engineer, R. N.

First year's training.—On entry he is engaged on practice work with the hammer and chisel, and after a short time commences engine fitting—useful work.

Second year's training.—For nine months he is employed at the lathe, and the remaining three months at other machines. During the second year a half-day per week for the greater part of the year is spent in sketching details of machines and parts of machinery.

Third year's training.—Eight months are spent in engine fitting in the students' shop, one month he is sketching details and learning the principles of construction of machinery used in connection with the discharge of torpedoes, such as air-compressing machinery, torpedo-tubes, both submerged and above-water—the latter as made and placed on board Psyche—and the remaining three months he is employed on repairs to engines, etc., of ships afloat, or as the opportunity presents itself, such as in the case of Psyche, in fitting new machinery in ships. It may here be observed that the testing machine for materials is placed in the students' fitting shop, and arrangements are made for the students in turn to become acquainted with the tests and the methods of carrying them out and of recording them—all very important matters in connection with an engineer's training. All the materials used in the manufacture of Psyche's engines were so tested in order to ascertain if they complied with requirements as laid down in specification; for instance, in the case of the gun-metal used the tensile strength must not be less than 14 tons with an extension in 2 inches of length of 7½ per cent., and in the case of high-tension cast bronze, such as used for the Psyche's propeller blades, the tensile was not to be less than 28 tons with 15 per cent. extension.

Fourth year's training.—The first six months are a continuation of the last three in the previous year, followed by one month in the coppersmiths' shop, where the short time renders it necessary their work should be more or less of a practical character, such as fitting patches, branches, and flanges, soldering and brazing, becoming acquainted with the method of running white metal into bearings and making sketches of the principal apparatus and processes generally appertaining to coppersmiths' work. This is followed by one month at smithing, in which the work is also of a practical character, such as welding and light forging. Then follow one month in each of the pattern shop and brass foundry, and two months in the boiler shop, in the last of which he obtains knowledge of riveting, tube rolling, etc. With reference to the boiler shop, there are invariably new boilers under construction, and all descriptions come under repair or observation. At the present time Belleville boilers are being manufactured for the Vestal, and tubes are being prepared for boilers of the small-tube type already in existence, including the following descriptions: Thornycroft, Yarrow, Reed, Mumford, Blechynden, Du Temple. Also the Babcock and Wilcox boiler is under observation. During the third and fourth years one evening a week for two hours is appropriated for instruction in drawing, under the direction and supervision of experienced draughtsmen.

Fifth year's training.—One month in the pattern shop and one month in the foundry similarly to fourth year, doing useful work. Three months fitting on ships afloat. Two months are appropriated for obtaining some acquaintance with the elementary principles of ship construction and the fittings of ships. The remaining five months are spent in the drawing-office learning engine drawing and design, the latter part of the time being occupied in the preparation of a drawing from his own sketches, which drawing is required to be done to enable him to pass into the navy. In order that the students may become acquainted with the working of machinery and the duties connected with the engine-room when under way, the Admiralty have set apart H. M. S. Sharpshooter for the purpose, and classes are taken from March till October. During March the ship steamed in the basin, and each third-year student is afforded the opportunities of actually performing the operations of laying and lighting fires, getting up steam, opening and regulating the various valves, attending to the working of the engines and boilers, and learning the various duties of the engine-room. The third-year students are divided into four classes, the course for each class lasting one week, four days under steam, the remaining two days for repairs, examination, etc. From April 1st to September 30th—except during examination and vacation times—the Sharpshooter is steamed under way by fourth and fifth-year students on two afternoons and one whole day a week, when all duties connected with the working of the engines and boilers and examination and repairs after steaming. are carried out by them. Each student by the end of his fifth year has passed through, in addition to the preliminary stage in the third year, four courses of steaming under way, each course of two weeks' duration. At the end of the season the ship is laid up for repairs, which are largely effected by the students themselves during the winter months. It should be noted that the Sharpshooter has triple-expansion engines, and was the first ship in H. M. Navy to be fitted with Belleville boilers, so that the steaming instruction afforded the engineer students by this ship is of very modern character.

Lectures on marine engineering are given to the various years by officers of the chief engineer's department at Keyham, eighteen per annum to the fifth year, and twelve to each of the other years. The time devoted to the Sharpshooter and to lectures is taken out of the students' working hours in the dockyard, which comprises four forenoons and five afternoons; the two remaining forenoons are devoted to educational subjects distinct from the dockyard, and under the direction of the head master. Sir William H. White, in his presidential address, delivered to this institution in April last, gave the various descriptions of machinery with which the modern warship is now supplied, and it goes without saying that with the growth of this machinery the necessity has increased for giving the officers who will be mainly responsible for its efficiency every opportunity for becoming familiar with it, and of becoming up-to-date naval engineers.

The facilities afforded at Keyham for the acquirement of a thoroughly practical training place the Royal Naval Engineering College in the foremost rank as an institution for obtaining a sound knowledge of mechanical engineering. The fact that as soon as possible after entry the student is employed on useful work, the various courses of instruction which are arranged to render the knowledge of marine engineering obtained as complete and as comprehensive as possible, the facilities afforded for acquaintance with running machinery, the constant contact throughout the training with experienced workmen, the frequent opportunities afforded for obtaining information from the officers who have charge of the training, all go to indicate that nothing is spared to make the training of the engineer student as complcte as possible.—*The Engineer.*

OFFICIAL TRIAL OF THE KENTUCKY.

The official trial of the new battleship Kentucky was held on November 24 over the government course from Cape Ann to Boone Island. It was shown that the Kentucky developed a little greater speed than her sister ship, the Kearsarge, which was recently sent over the same course. The contract with the Newport News Shipbuilding and Dry Dock Company, her builders, required that she should develop a speed of 16 knots. The official corrected returns of the government officials showed that the Kentucky made an average speed of 16.897 knots.

The course over which the Kentucky was run is 66 miles long, and it was divided into five sections of .66 knots each, the vessel covering the 33 knots outward and turning making the same distance back. The vessel covered the first leg of the course in 23 minutes 46 seconds, showing a speed of 16.658 knots. On the second leg she covered the distance in 23 minutes 55½ seconds, making a speed of 16.551 knots. On the next three legs she increased steadily until she reached 17.018 knots on the fifth leg, which she made in 23 minutes 13½ seconds. On the return the vessel averaged 16.932 knots, exceeding 17 knots on the first and last legs. The final division of the course was covered in the fastest time made during the day, 22 minutes 57 seconds, or a speed of 17.254.—*Army and Navy Register.*

OUR FASTEST BATTLESHIP.

The Alabama in a preliminary builders' trial has made an average speed of 16.3 knots over a 23-mile course, a maximum speed of 17.2 knots having been made with the wind and tide, and a speed of 15.43 knots against them. On this occasion the Alabama did not carry any of her guns, and a large amount of her armor had not yet been bolted on, so that she was probably from 1500 to 2000 tons short of her trial displacement of 11,525 tons. At the same time she was undoubtedly very foul as the result of being afloat for over a year at the Cramps' shipyard. It is reasonable to expect that on her official trial, with a clean bottom and under the favorable conditions of the best of coal and expert stokers, she will be capable of repeating the performance in spite of her greater displacement.

The good showing of the Alabama, however, has been eclipsed by that of the Kearsarge, one of the pair of fine battleships that is nearing completion at the yards of the Newport News Shipbuilding Company. This vessel has also been afloat for over a year, the date of her last visit to drydock being August 8, 1898, and on the occasion of her informal trial she carried the whole of her armor, together with the heavy guns of the 13-inch and 8-inch batteries, the only weights not carried being those of the 5-inch guns of the intermediate battery. Hence her displacement and draught were only slightly below what they will be at her official trial. Under these conditions the ship made by log during half an hour's steaming under forced draught a speed of 17.25 knots an hour.

The trial was made in water whose depth varied between ten and twelve fathoms, and it is a well-understood fact (though only discovered a few years ago in the trials of some high-speed cruisers) that a difference of fifteen or twenty fathoms in the depth of water on a trial course will have a very marked effect upon the speed of a deep-draught warship. Hence it is reasonable to expect that when the Kearsarge is put in the trial-trip shape, she will be capable of maintaining an 18-knot average over the deep-sea trial course. If she does this, our latest first-class battleship will easily be our fastest, the Iowa coming next with a trial speed of 17.08 knots per hour.—*Scientific American.*

OFFICIAL TRIALS OF THE SHIKISHIMA.

On May 1, 1897, the first plate of the keel of this vessel was laid, and within twenty-nine months—notwithstanding a six months' delay in the delivery of armor, armament and engines, due to the unfortunate engineers' strike—her trials have been completed to the entire satisfaction of all parties concerned. This probably constitutes a record in the history of battleship building, and the fact that a war vessel of some 15,000 tons displacement and 19 knots speed can be completely built, equipped, armored, armed and engined in a little over two years, speaks volumes for British methods. The vessel having been drydocked at Portsmouth, and her bottom having received its final coating of anti-fouling composition, she left that port for Torbay, to run an eight-knot course in deep water.

The engines worked very well during the whole of the time, indicating upwards of 15,000 horse-power on the measured distance, whereas the contract with Humphrys, Tennant & Co. was 14,500, and she attained a mean speed of 19.023 knots at slightly over her load draught of 27 feet 3 inches. She turned a complete circle in 3 minutes 16 seconds, heeling only 5 deg., her rudder being put from hard over to hard over in 16 seconds, again demonstrating the value of the Cameron gear, actuated by Brown & Co.'s telemotor gear.

Her auxiliary armament was tested with satisfactory results on her way round from Portsmouth, but not the slightest sign of weakness was discovered anywhere, and not a single pane of glass was broken. However, the four 12-inch guns have yet to be fired, which will, of course, test her construction more thoroughly.—*The Engineer.*

The London, battleship, was launched at Portsmouth on the 21st inst. by Lady George Hamilton. The displacement of the London at the time of taking the water was about 5000 tons, including the launching ways, but when completed she will displace 15,000 tons. The new vessel is of the following dimensions: Length between perpendiculars, 400 feet; extreme breadth, 75 feet; mean draught—forward 26 feet 3 inches, aft 27 feet 3 inches. Her inverted, vertical, triple-expansion engines, made by the Earle Company, of Hull, will have an indicated horse-power of 15,000; her boilers are of the Belleville type. Her speed will be 18 knots, and her coal stowage 2040 tons. The complement of the great vessel, when she is ready for sea, will be 773 persons, exclusive of an admiral and his staff, if carried, for whom accommodation is provided. The armament of the London will consist of four 12-inch breech-loading wire guns, twelve 6-inch quick-firing guns, sixteen 12-pounder quick-firing guns weighing 12 cwt. each, two 12-pounder quick-firing guns weighing 8 cwt. each for boat use, six 3-pounder quick-firing guns, and eight .45-inch Maxims. Four submerged torpedo-tubes and fourteen 18-inch and five 14-inch torpedoes complete her powers of offense. The thickness of the armor plating in various parts is thus described: For 216 feet of the sides, 9 inches, tapering beyond this length towards the bow to 2 inches; on bulkheads, 12 inches, 10 inches and 9 inches; on barbettes, 12 inches, 10 inches and 6 inches; on casemates, 6 inches; on fore conning tower, 14 inches, with 8-inch communication tubes; on the after conning tower, 3 inches, with 3-inch communication tubes; on the twelve gun-shields, 8 inches and 10 inches; on the roof and floor of the same, 3 inches of Harveyized nickel steel. The following are the particulars of the protective deck plating: Middle deck between armor bulkheads, two thicknesses of 1 inch, with an extra thickness of 1 inch on the slopes over the machinery spaces; lower deck before forward armor bulkhead, two thicknesses of 1 inch; lower deck abaft after armor bulkhead, two thicknesses of 1 inch and ½ inch respectively; main deck between armor bulkheads, two thicknesses of ½ inch. The London will have two steel masts, each fitted with a military or fighting top, and with a searchlight platform on the main topmast, and a long-distance semaphore for signaling at sea will be fitted. This semaphore is about 160 feet above the level of the water-line. The masts are to be provided with three derricks, two forward and one on the mainmast, and these derricks, primarily fitted for hoisting out the boats, will be of great utility when coaling. The boats include four steamboats, two 56 feet in length and two 40 feet in length, and 14 sailing and pulling boats, ranging from a 42-foot sailing launch to a small dinghy. The two larger are capable of steaming about 13.5 knots, and are fitted with torpedo-dropping apparatus. They will also act as scouts whilst the parent ship is in harbor. Three independent sets of dynamos and engines are required to light the ship, work the electric motor, fans and searchlights. Every compartment except the double bottom, etc., will be efficiently lit by incandescent lamps.—*Engineering.*

The new battleship Bulwark, launched at Devonport on October 18, was laid down on March 20, and has thus been under construction less than seven months. During that time 5450 tons of material have been built into her, and it is claimed by the Devonport dockyard staff that the work has created records both in the time she has been under construction and in the weight attained for the period. The main dimensions of the ship are: Length between perpendiculars, 400 feet; extreme breadth, 75 feet; draught of water (forward) 26 feet 3 inches, (aft) 27 feet 3 inches; load displacement, 15,000 tons. She will be fitted with two complete sets of engines of the vertical triple-expansion type, of 15,000 indicated horse-power, and is expected to attain a speed of 18 knots. The engines, which are being made by Messrs. Hawthorn, Leslie & Co., of Newcastle-on-Tyne, have cylinders 31½ inches, 51½ inches and 84½ inches in diameter, and a stroke of 51 inches. Each set, in a separate room, is to be capable of developing 7500 horse-power, with 108 revolutions per minute. There will be twenty boilers of the Belleville type. The armament will comprise four 12-inch breech-loading guns, worked in two barbettes, twelve 6-inch quick-firing guns in casemates; sixteen 12-pounder 12-cwt. quick-firing guns; six 3-pounder Hotchkiss quick-firing guns; one 12-pounder 8-cwt. boat gun, one 12-pounder 8-cwt. field gun, and eight .45-inch Maxim guns. She will also have four submerged torpedo-tubes. When commissioned the vessel will have a total of 773 officers and men. The Bulwark and her sister ships are identical in form, dimensions and displacement with the Formidable class, but differ slightly in the distribution of armor protection. In the Venerable class the belt of side armor is carried much nearer the bow than in the Formidable class, while the fore armored bulkhead, which is a feature in the Formidable class, has been dispensed with.—*The Engineer.*

THE U. S. NAVAL ACADEMY PRACTICE SHIP CHESAPEAKE.

For many years the cadets of the U. S. Naval Academy at Annapolis have been compelled to make practice cruises in old vessels fitted temporarily for this purpose, but in reality unfit for the special purposes of training. In 1897, however, Congress took action looking toward the construction of a vessel exclusively for this use. The result is the Chesapeake, built by the Bath Iron Works and now fitting out at the Charlestown Navy Yard, Boston, Mass. Under the advice of the naval officers immediately concerned, at the time, a sailing vessel was decided upon. We do not propose in this article to discuss the advisability of adopting an obsolete type of vessel for the purpose, but simply to describe her construction and arrangements. These and her battery comprise the modern features of the vessel.

Designs for the Chesapeake were prepared by the Naval Bureau of Construction and Repair, under the direction of the Chief Constructor, Philip Hichborn. She is the first sheathed vessel to be built in this country and the only sailing vessel that has been added to the navy in over thirty years.

The original appropriation for the vessel made by Congress in 1897 was unfortunately confused. After deciding that a full-rigged sailing ship was the proper type of training vessel for the cadets, the wording of the bill was such as to include propulsion by both sail and steam, although the estimate in the hands of the committee did not cover such a design. In amending the bill to exclude steam propulsion a great error was committed, as the appropriation was reduced to but $125,000, or one-half the amount required. The design was developed as originally intended, and the contract for the construction of hull and fittings was awarded to the Bath Iron Works, March 16, 1898. Additional funds were made available in February, 1898, the total appropriation being raised to the required amount of $250,000. The keel of the Chesapeake was laid August 2, 1898. She was launched June 20, 1899, and on July 11 she left the yard of her builders and was handed over to the U. S. Government at the Boston Navy Yard. The spars, boats, outfit and furniture have been made at the Boston Yard.

Following are the dimensions and the most interesting particulars concerning the hull of the Chesapeake:

Length over all	223 ft. 6 in.
" L. W. L	175 "
Beam, extreme	37 "
" molded	36 " 3 in.
Freeboard, for'd	14 " 3 "
" aft	14 " 3 "
" amidship	11 " 3 "
Draft, mean	16 " 6 "
" aft	17 " 6 "
" for'd	15 " 6 "
Displacement	1190 tons
Area of midship section	378 sq. ft.
" " load water plane	4570 " "
Tons per inch of immersion	10.86 tons
Meta-centric height	3.6 ft.
Range of stability	120 deg.
Max. righting arm	2.5 ft.
" " moment	2975 ft. tons
Angle of Max. righting arm	58 deg.

The following general schedule of weights will also be of interest:

Hull and fittings	710 tons
Boilers, pumps, piping, etc	45 "
Armament and ammunition	66 "
Equipment and outfit	223 "
Coal	22 "
Ballast	123 "
Total	1190 "

The Chesapeake is a very lean vessel with high freeboard, and closed bulwarks throughout her length. She has considerable deadrise, the angle of her floors being 25 deg. with the horizontal base line. There are three continuous decks, two of which are plated with steel throughout. The steel construction of this vessel is very heavy, and she is sheathed with 4-inch Georgia pine in addition to having a steel bottom and sides fully equal in scantling to any steel gunboat of her size afloat.

Fore and aft water-tight wing bulkheads 62 feet long are worked in the hold amidships. These bulkheads inclose the magazine forward, the boiler-room, the sail-room and the fresh-water tanks aft. In the wings are the electric stores, cadets' stores, medical stores and coal-bunker on the port side, and the ordnance stores, bread-room, warrant officers' stores, equipment stores and coal-bunker on the starboard side.

The boiler-room is 16 feet long and 14 feet 6 inches wide. In it are located two steel Scotch boilers 8 feet long and 6 feet 6 inches diameter, with single furnaces; a condenser with 150 square feet of cooling surface; an air and circulating pump 4½ by 5 by 6 by 6; a fire and bilge pump 10½ by 6½ by 10; feed pump 4½ by 3 by 6, and a feed tank. The smoke pipe is 3 feet outside diameter, the height above the top of grate being 42 feet. There are 15 fresh-water tanks in the hold. The average size of these independent tanks is 6 feet by 4 feet by 6 feet. The total capacity of these tanks is 15,030 gals. of fresh water. The after magazine is located aft of the tank spaces, the paymaster's stores being on each side of it in the wings.

The ward-room stores and navigation stores are located aft, and the general stores and chain and sand locker are located forward. A trimming tank is located at each extremity of the vessel. On the forward berth deck is located a general storeroom. Then comes the crew's space, divided into two parts by a water-tight steel bulkhead, aft of which is the fire-room hatch, dynamo-room with 2 generators (the plant being in duplicate), distilling-room and refrigerating-room. The evaporation shell is 4 feet diameter and 5 feet 6 inches long over all, size 2-s-120. The distillers are 2-s-98. The evaporator feed pump 6¼ by 4⅜ by 8, and the distiller circulating pump 3 by 2½ by 4. In the refrigerating-room a one-ton Allen dense-air ice-machine is fitted.

On the port side of the berth deck amidships are located the dispensary, sick bay, with bathroom and w. c., paymaster's office and ward-room pantry. On the starboard side the warrant officers' mess-room, carpenters' and boatswain's rooms, and quarters for a few of the cadets. On the berth deck aft is the ward-room, dining-room, ten staterooms and bathroom, complete in all respects. On the gun deck forward is the manger, with lamp-room and small stores. Then comes the cadets' shower-baths and dressing-room, cadets' washroom, warrant officers' and ward-room officers' w. c. on the port side, and the crew's w. c. and cadets' w. c. on the starboard side. A Hyde patent steam capstan windlass with wildcats for 1½-inch chain is located between the wing w. c.'s. The cadets mess and swing their hammocks on the gun deck amidship. Here eight mess tables 12 feet by 3 feet, with seats for fourteen at each table are carried. In the center of this deck are the galleys, pantries, etc., and aft are the executive officer's office, navigator's office, armory, captain's stateroom, cabin, bath, pantry and office. Six 4-inch rapid-fire guns are carried on the gun deck, three on each broadside, two forward, two amidships and two aft, each having 45 deg. angle of fire on each side of a line square with the center line of the ship.

The spar deck of the Chesapeake is a good clear deck fore and aft. A small monkey forecastle is worked forward, the space beneath it being used for the stowage of deck gear. Two 6-pounders are carried forward on the spar or weather deck, two are carried aft, and two 1-pounders are located amidship. A Hyde-Robinson improved hand screw steering gear is located on the deck aft, the vessel having no steam steering gear. Seven boats are carried, viz.: a 30-foot steam cutter, a 30-foot launch; two 28-foot cutters, a 28-foot whale boat, a 28-foot whale-boat gig, and a 20-foot dinghy.

The vessel has no chart or pilot-house, but a large navigating bridge is located aft, just forward of the mizzen rigging. Pin rails, fife rails, topsail sheet bits, cavils, cleats, bits and fair leads are located on deck to the best possible advantage.

The Chesapeake is a full-rigged sailing ship, with three masts spreading 19,975 square feet of sail all told; the area of the ten principal sails is 13,131 square feet. The fore truck is 130 feet above the water-line, the main is 142 feet, and the mizzen is 115 feet. The following gives the lengths of the yards and fore and aft spars:

Fore lower yards	68 ft.
" topsail "	51 ft. 6 in.
" topgallant"	34 ft.
" royal "	24 ft. 3 in.
Main lower "	78 ft.
" topsail "	66 ft.
" topgallant"	45 ft. 9 in.
" royal "	33 ft.
Mizzen lower "	51 ft.
" topsail "	38 ft.
" topgallant"	25 ft.
" royal "	18 ft.
Fore spencer gaff	27 ft.
Main " "	27 ft.
Spanker gaff	35 ft. 6 in.
" boom	53 ft. 6 in.
Jib boom outboard	41 ft. 3 in.

The center of effort of the sail is 8.33 feet forward of the center of lateral resistance and 57.95 feet above the water-line.—*Marine Engineering.*

THE CHILIAN TRAINING-SHIP GENERAL BAQUEDANO.

It is a noteworthy feature of the present age that, at a time when masts and yards are utterly dead for warships, all nations not merely adhere to sail-power for their training-ships, but actually build vessels for the purpose, in which steam is merely an auxiliary. It means, of course, a general recognition of the value of sails and the working of them in the making of sailors—a certain carelessness of life being thus imparted, which is not to be acquired in any other way. There is, further, the physical training, which is better in exercises aloft than in the formal physical drill on deck. There are some indeed who have argued that the stokers would be better for "drilling in the sky"; and in so far as training stokers in deck duties has improved their physique as a class, there is possibly something to be said for the matter. In the Russian Navy it is said that something of the sort has been actually done.

However, at present masted training-ships are only intended for the men whose duties lie in working guns, and for executive cadets, who are particularly supposed to need sky drill. The first vessel built in modern times to be primarily a sailing training-ship was the Benjamin Constant, a Brazilian vessel launched at La Seyne in 1892. Her speed is merely a nominal 14 knots, though she carries the rather powerful armament of four 6-inch and eight 4.7-inch quick-firers upon special mountings, designed, we believe, at Elswick. She had too good an armament, however, for a Brazilian training-ship, and so has drifted into being a cruiser. Originally she was full-ship rig; now the main has altogether been removed, the fore and mizzen cut down and made into military masts. Indeed, we have heard that the Brazilians have been adding or subtracting military tops to and from the foremast of the Constant ever since.

Russia set afloat the next training-ship—the Vernii, a vessel without any steam motive power at all. Subsequently and recently Argentina and Chili concluded that each needed a training-ship. The former power ordered the Sarmiento at Laird's; while Chili ordered the Baquedano at Elswick. In both ships the same main idea obtains—sails as the chief motive power, steam as an auxiliary, while each carries an armament, so that in war time she shall not be useless. And carrying as they do the latest thing in artillery, they might be formidable antagonists to older and more powerful ships in those waters.

Comparing the two, we see how similar is the general idea:

	Presidente Sarmiento.	General Baquedano.
Launch	1897	1898.
Displacement	2750 tons	*Circa*, 2300.
Armament, all quick firers	Five 4.7-in	Four 4.7-in.
" "	Two 14-pounders	Two 12-pounders.
" "	Four 6-pounders	Two 6-pounders.
" "	Four 3-pounders	
" "	Four machine	Two Maxim guns.
Torpedo tubes	Two	One 18in.

Both are full-rigged, single-screw ships, with speeds of about 13.5 knots. The remaining details of the General Baquedano are: Length, 277 feet; extreme breadth, 45 feet 9 inches; depth, 25 feet 2 inches; mean draught, 18 feet.

She is built of steel and sheathed with teak, and is designed to carry a complement of about fifty officers and 250 men. Her length over all is 277 feet; breadth extreme, 45 feet 9 inches; depth, 25 feet 2 inches; mean draught, 18 feet; and her displacement, about 2300 tons. She is barque-rigged, having a sail area of about 17,500 square feet, and carries vertical triple-expansion engines of 1500 indicated horse-power, built by Messrs. Hawthorn, Leslie & Co., driving a single screw, of the Bevis patent feathering type. Her boilers, four in number, are of the Belleville water-tube type, and she has bunker capacity for 350 tons of coal. During her recent steaming trials she attained a speed of 13.75 knots.

She carries a 28-foot steam launch, which steams at a speed of 7½ knots per hour; and nine other boats, one of which is specially fitted to carry submarine mines. She can accommodate 14,500 gallons of fresh water in her tanks, and has distilling plant capable of producing about 4400 gallons per day.—*The Engineer.*

THE FRENCH AND RUSSIAN NAVY ESTIMATES.

The French Navy Estimates for 1900, just issued, show some interesting changes. The total vote is $60,000,000, which is $2,000,000 more than in the previous year. The greater part of this increase is due to guns, just as Russia's is due to harbors and guns. For construction purposes, $20,000,000 are asked, and this is $230,000 more than in the current year, but it may be remembered that $400,000 of a supplementary vote was granted, so that the expenditure next year will really be less than in the current year. It has not been decided what new vessels will be ordered, but there is a fairly large programme to advance, although it is made up mostly of small craft. The two Estafette cruisers of 4000 tons and 26 to 27 knots speed have yet to be ordered; the elements of design with this high speed are not so easy of solution. The other ships laid down this year include two battleships, one at private works and the other, the Marseillaise, at Brest; two submersible torpedo-boats at the government dockyards and four by contract; four squadron torpedo-boats by contract, eleven torpedo-boats, four torpedo-boat destroyers, two river gunboats building in England—the Argus and Vigilante. Thus, of the total vote for new construction only about $5,000,000 is to be spent on new construction, while $4,200,000 is to be devoted to repairs, etc. The vote for guns shows an increase of $1,300,000, the total being $6,000,000, of which $5,500,000 is for new weapons, due to the requirements of new vessels, auxiliary cruisers, and new coast batteries. The addition of men for active service has involved an increase to many of the votes. The total augmentation of the personnel is 2145, of whom 1350 are in the first-class reserve, which is thus brought to 5903. The sea service includes 35,673, an increase over the current year of 623, and the land service 4815, an augmentation of only 172. This addition to personnel has rendered necessary some economies in several directions, and a careful examination of all the details indicates that the principal effort is being directed to perfecting of the munitions of war already possessed rather than to the accumulation of new war material. In one or two cases there will be substituted new for old ships, but any change numerically is towards reduction. Thus the Foudre and the transport Japon are to be withdrawn from the Mediterranean fleet "for reasons of economy." The instructional division is to be reduced, one of the six coastguard ships and three of the cruisers are to be passed into the first-class reserve. The Northern squadron has also been strengthened, and will cruise for longer periods. The two river gunboats building in London are for participating in the work of exploration in China, and they will be ready early in 1900.

The Russian Naval Estimates for 1900 have been prepared, and they total $48,500,000, as compared with $46,000,000, an increase of two and one-half millions; but the significance of the increase is more marked when it is noted that at the beginning of this decade 22 millions was considered a large expenditure on the Russian Navy, irrespective of special naval schemes, which are now the fashion in Russia as with other nations. The shipbuilding vote comes to $16,000,000, which is rather less than in the previous year, but fully double that of 1890. This is partly due to special votes for the navy scheme that extends over a period of years. The guns and electric fittings, which are not included in this shipbuilding sum, require 5 millions, against $1,600,000 in 1890. The wages of the effective staff, which is some measure of the strength at peace times, is $2,600,000, as compared with $1,900,000 in 1890; and in non-effective service—for administration, dockyard staffs, etc.—nearly half a million more is required. An interesting feature of the estimates is the sum required for new strategic harbors. In the current year $2,000,000 was voted for Libau, or, as it is officially termed, Port Imperator Alexander III, and for Vladivostock. Next year there will be spent at the first-named $1,000,000, at Vladivostock $1,600,000, and at the new Far Eastern Russian port of Port Arthur, which appears in the estimates for the first time, the same amount. Thus, for the three harbors over five millions is to be voted, as compared with $2,000,000 in the current year.

The French Parliamentary paper (Etat H) embodying the shipbuilding programme has just been presented to the Chamber. It includes 112 vessels of all classes, of which 22 are described as completed and 67 as in hand, while 23 are proposed or begun. In the first category are the battleships Charlemagne, Saint Louis, and Gaulois, the commerce-destroying cruisers Guichen and Châteaurenault, two third-class cruisers, one gunboat, and 14 various torpedo craft. The largest of the vessels in hand are the battleships Henri IV, Jéna, and Suffren, and the armored cruisers Jeanne d' Arc, Dupetit-Thonars, Gueydon, Condé, Gloire, Dupleix, Kléber, Desaix, Montcalm, Sully, Marseillaise, and Admiral Aube. The various torpedo craft in the list are 10 destroyers and 38 boats of other classes. The vessels in hand are classified as follows in regard to their anticipated dates of completion:

——	1900.	1901.	1902.	1903.	Total.
Battleships	2	1	..	..	3
Armored cruisers	1	5	3	3	12
First-class "	1	..	..	..	1
Destroyers	6	..	4	..	10
Gunboats	3	..	..	..	3
Submarine	3	..	6	..	9
Squadron torpedo-boats	6	4	..	..	10
First-class "	9	9	..	..	18
Turbine torpedo-boat	1	..	..	..	1
Totals	32	19	13	3	67

The shipbuilding programme for 1900 is in a sense provisional. M. de Lanessan has announced his attention of presenting a scheme for the increase of the fleet, but is expected to take the advice of the chiefs of the navy, and will be heard on the subject by the Budget Committee. The principal vessels now proposed to be laid down are two battleships, A 8 and A 10 (Brest and Toulon), the largest yet built in France, and an armored cruiser, C 11 (Cherbourg). The plans of the battleships indicate a displacement of 14,865 tons; length, 439 feet; beam, 78 feet 9 inches; stern draught, 27 feet 6 inches; armament, four 12-inch breech-loaders, eighteen 6.4-inch, twenty-six 1.8-inch, and two 1.4-inch quick-firers, and five torpedo-tubes, of which two are submerged; vertical triple-expansion engines of 17,475 indicated horse-power, supplied by water-tube boilers, and driving three screws, to give a speed of 18 knots; normal coal capacity, 905 tons; extreme, 1825 tons; complement, 42 officers and 780 men. The armored cruiser is intended to displace 12,416 tons, with a length of 475 feet 9 inches; beam, 71 feet 2 inches; draught, 26 feet 3 inches; armament, four 7.6-inch, sixteen 6.4-inch, two 1.8-inch, and four 1.4-inch, and five torpedo-tubes, of which two are submerged; vertical triple-expansion engines of 24,000 indicated horse-power, supplied by water-tube boiler, driving three screws, and giving a speed of 21 knots; coal capacity, 1350 tons; complement, 23 officers and 687 men.—*Engineering.*

THE TRANSPORT OF TROOPS.

A great fleet of vessels has been hastily chartered for the conveyance of an army corps to the war now being waged against the Boers in the South African Republics, amounting to nearly 150 ships whose aggregate tonnage exceeded 670,000 tons. That is a large fleet; but, as we pointed out some time ago, in dealing with our great merchant fleet, it forms a comparatively small proportion of the shipping owned by Britain, so that it might have been possible, under certain conditions, to have chosen even more conveniently equipped and faster vessels. As regards speed, we find that two of the vessels can steam 18½ knots, both Castle liners; one 18 knots, an Orient liner; one 17½ knots, an Anchor liner; two 17 knots, a Cunard and P. and O. ship; two 16½ knots, a Cunard and White Star vessel; two 16 knots, an Orient and an Allan vessel; three 15-knot vessels, all Castle liners; four 14½-knot P. and O. boats, and one Union steamer. It is no part of our duty to discuss politics, and we therefore pass from this matter of choice with the remark that when the need for transports was recognized the Government was able to secure the ships without seriously discommoding our merchant service. Since a large proportion of the troops came from India, it was only to be expected that the British India Steam Navigation Company should supply the largest contribution of any line—twenty-five vessels of 90,575 tons. Then come several lines each with seven large vessels, including the Castle Line, Elder, Dempster & Co., the Cunard Company, and the Union Line. The tonnage of the Castle liners was 41,263 tons; but, in addition, they have sent a large number of troops and munitions of war by their ordinary steamers. Up till now they have sent 10,127 officers and men, including General Buller and his staff, and they have also had the satisfaction of landing the first of the army corps this week.

The Kildonan Castle is the most important of the troopships yet sent from this country. This vessel was only launched on August 22 by the Fairfield Company, and was to be handed over in February next; but on October 6 she was chartered by the Government, 3000 men were put on board by the Fairfield Company, first to tear out such passenger cabins, etc., as minimized the space which could be given over to troops, and subsequently to construct such special fittings as were necessary to accommodate 3000 men. The work was completed within three weeks, and the vessel sailed on November 4, and will land next week at the Cape 96 officers, 2225 men, six horses, a large consignment of Royal Engineers, pontoon building, balloon, and other equipment, besides many guns and much ammunition, and all within three months of her launch as a steel shell—a performance eminently creditable to the Fairfield management and to the Castle Line. Kits and lifebelts are stowed on temporary timbers between the deck beams, and these again carry the hooks for the hammocks, which during the day are stowed along the casings. The tables are collapsible and may be disposed of in a few minutes. Two decks are thus arranged. At the forward end there is an armory where there are stored, tier upon tier, over 3000 rifles and other arms. Forward also there are four cells in the ward-room, one of them well padded with straw. Aft there is a ward hospital, so arranged as to be divisible into separate and isolated wards. The ordinary cuisine is very extensive, but additional kitchens were fitted. The electric light will be a joy to the soldiers, no matter in what part of the ship they are, and the matter of ventilation has had special attention. Another important point is that 13,000 gallons of drinking water can be distilled each day, so that the little army which is now afloat in the vessel have special comforts.

A word may here be said also of the splendid arrangements made by the London and South-Western Railway for the transit to, and embarking at, Southampton of the troops. Nearly one-half of the troops sent to South Africa have embarked at Southampton. Up to the end of last week 26,578 men, 906 officers, about 100 horses, and a large number of guns, etc., have been despatched from the southern port in twenty-three vessels totalling 34,336 tons gross. Some of these, however, were regular liners, not troopships in the usual sense. The figures do not include such non-combatants as doctors, nurses, etc. The southern port has proved itself admirably suited for the work; the Empress Dock and the new wharf which stretches down Southampton Water have been used. The railway runs alongside the steamers, and on the wharves there are a large number of hydraulic cranes running on rails. Thus guns, carriages and horses, etc., were quickly embarked. On one day five steamers were despatched, taking with them, besides government stores, 167 officers, 4756 men, 24 horses, 38 vehicles and five guns. All five vessels left between 2.30 P. M. and 4.30 P. M. Nine transports, several of them vessels of 5000 and 6000 tons, were alongside at the same time, besides the ordinary liners. The company, too, have won golden opinions for the facility with which they have dealt with the railway traffic incidental to the embarking of the troops. To entrain and pass over the main line within a few hours 5000 or 6000 men with their accoutrements, in addition to the usual heavy traffic, was a splendid feat alike for the general manager and locomotive superintendent.—*Engineering.*

(Fire-proof)

NON-FLAMMABLE WOOD (for ships)

Paper read before the British Association by Mr. E. Marshall Fox.

The author commenced by saying that more than sixty years ago the subject received attention at the hands of Faraday, who demonstrated that there were many chemicals possessing the property of rendering wood more or less uninflammable. Among the chemicals found by him and other experimenters to be adapted for this purpose, have been tungstate of soda, silicate of soda, boracic acid, borax, sulphate of magnesia, aluminum and sulphate of lime, all of which gave some measure of success in laboratory experiments, but it is only quite recently that non-inflammable wood has become a product of practical utility. No more immediate or pressing need for wood that will not catch fire exists than in ships of war. The naval engagements between the Chinese and Japanese fleets in 1894 showed that fire is a potent factor, for the woodwork on the Chinese warships Tung Yung, Chao Yung, Lai Yung and Yung Wei caught fire from the shell of the enemy and brought about the destruction of those ships. Early in 1895 the Secretary of the American Navy appointed a commission to examine into a new process for rendering wood non-inflammable to which his attention had been called. As the result of such examination the product was placed experimentally on two American cruisers then building, and after several months of trial, during which it gave the fullest satisfaction, its use was extended to other American ships of war. In the summer of 1897, however, a re-examination of the subject was ordered by the United States Government, owing to reports that the treated wood presented difficulties in its working and painting, and sometimes corroded metals in contact with it, and absorbed more moisture than ordinary wood. The result of such re-examination was that the Government approved its use and extended it to all the new ships of war then under construction, and in many cases much of the woodwork of ships already in commission was taken out and non-inflammable wood substituted. At the present time nearly all the woodwork of the principal warships of the United States consists of non-flammable wood. The vulnerability of ships fitted with ordinary woodwork was strikingly shown in the naval engagement off Manila in May, 1898, between the warships of the United States and Spain, when the Reina Christina, Castilla, Don Juan de Austria, Velasco, and other Spanish ships were destroyed by their woodwork catching fire from the American shell. The immunity against risk of fire of ships fitted with non-flammable wood was demonstrated a few weeks afterwards in the naval engagement off Cardenas, Cuba, when the American torpedo-boat Winslow and the gunboat Wilmington were several times hit by Spanish shell, the former being shot through and through, yet no fire occurred on either vessel, both being fitted with non-flammable wood. In the naval engagement off Santiago de Cuba on July 3, 1898, the American ships, though struck many times with shot and shell, suffered no damage from fire, while the Spanish ships, Maria Theresa, Almirante Oquendo and Viscaya, were destroyed by conflagration caused by the American shell through setting fire to their woodwork. Some two years ago the Admiralty commenced testing wood treated by the process employed in the American warships with the result that after several months of trial, such wood was specified for the woodwork of the Royal yacht, and also for the various battleships, cruisers and torpedo-boat destroyers now in course of construction. Samples of the wood treated were shown by the author. The method of treatment consists in placing the wood in closed cylinders of steel, and then subjecting the wood to alternate applications of heat and steam for definite lengths of time, after which the steam is blown off and the air exhausted from the cylinder; a solution consisting of fireproofing and antiseptic chemicals, the principal ingredient of which is phosphate of ammonia, is then admitted. The pressure pumps are then put in operation and the liquid forced into the pores of the wood. The cylinders used for the purpose measure 100 feet in length, and 7½ feet in diameter, and consist of ⅞-inch steel, tested to a pressure of over 300 pounds, per square inch. The door is an important feature of the cylinder, as it must be made to resist great pressure without leakage of air or liquid. It weighs 7 tons and is secured by an arrangement of radial bolts that cause it to effectually resist the pressure. The wood to be treated is placed on low-wheel trolleys, with space between each board to admit of the solution penetrating all around, and the trolleys are run on trucks into the cylinders. The degree of heat, steaming, vacuum and pressure varies according to the character of the wood under treatment; hard woods being treated in different cylinders from the soft woods, and requiring a different treatment. The time required in the cylinders varies according to the kind of wood being treated. Not all woods are amenable to the process, some because of the large quantity of resin or oil that they contain, and some because of the irregular character of their fibers resisting impregnation. Teak, Austrian oak, and American pitch pine are particularly resistant, and require much longer and more drastic treatment, to be made uninflammable. Yellow deal, white pine, mahogany, ash, elm, walnut, birch, cherry, and English oak, on the other hand, lend themselves readily to the treatment. The thickness of the wood forms an important feature. Of the softer woods, 3 inches to 4 inches in thickness can be impregnated, but in harder woods rarely more than 2 inches can be thoroughly treated. For all practical purposes, however, it has been found in tests that impregnation of 1 inch on all sides renders the wood non-flammable throughout. The amount of solution taken up by the softer woods is greater than that absorbed by the harder, and varies in the different natures. White pine and yellow deal take, as a rule, more than double their original weight. This feature necessitates different strengths of solution for various woods in order to obtain uniformity in the degree of non-flammability imparted. After the wood has become thoroughly impregnated, it is removed from the cylinders and dried, leaving the resultant fireproofing chemicals deposited in the pores. The thorough drying of the treated wood is of the greatest importance, and is accomplished by placing it in kilns, where a uniform temperature of dry air, not exceeding 120 deg. Fahr., is kept in constant circulation by means of rotary fans. After the wood is thoroughly dry it is ready for use.

The author next proceeded to give details of a number of trials made which appeared to fully prove the fire-resisting nature of the process he described. He also exhibited before the meeting some experiments proving the non-flammable nature of the treated wood.—*Engineering.*

ELECTRIC AUXILIARY MACHINERY IN THE UNITED STATES NAVY.

By Alton D. Adams.

Since the tests on board the Minneapolis by Mr. W. W. White, which showed that her steam auxiliaries consumed 119 pounds of water per horse-power hour on the average, especial attention has been turned to the subject of electric driving. The plan for electric driving is, briefly, to substitute for each small auxiliary steam engine an electric motor of equal capacity, and to install enough electric generators, directly connected to compound engines, for the maximum demand of these motors at any one time. Efficiency is the great advantage that has been claimed for the electric equipment, as it is readily shown that compound engines, electric generators, and motors require only about one-third the weight of steam per hour demanded by the small engines now in use for the same work. This decided gain in efficiency is quite generally admitted, but the various arguments for and against the proposed change have been in some cases amusing rather than instructive.

For instance, one writer has said, " At the same time it is impracticable to install on board ship dynamos of more than 1000 amperes, so that thirteen dynamos would be required to give the necessary power at 80 volts," but has not explained the mysterious reasons which would prevent dynamos giving 5000 or 10,000 amperes working to that entire satisfaction on warships which they commonly give on shore.

Again, another recent writer has said: " Such a voltage (80 or 100) is, however, entirely unsuited for a 1000 horse-power plant. The weight of the distribution system would not only be excessive, but the size and weight of the generators would be prohibitive," although the facts are that the weight of conductors for the distances on board ship, at 100 volts pressure, would probably not exceed 10 per cent. of the present steam-pipe weights for the same work, and that the change from 100 to 250 or 500 volts pressure would not decrease the weight of electric generators more than 5 per cent.

An increase in pressure of electric plants on warships is to be desired in order to diminish somewhat the cost of electric conductors, and the care of brushes and accumulators; but this is a decidedly minor matter, and failure to abandon the present standard voltage should not be stated as fatal to electric driving. Conclusions as well as arguments differ on this subject, one having said: " We are driven, therefore, irresistibly to the conclusion that, although electric auxiliaries offer very many advantages, their great cost and the amount of space they would occupy render a complete installation of them of doubtful benefit, while their great weight makes it absolutely out of the question."

Another concludes that "The electric plant, with the generating sets described, will weigh between two and a half and three times the steam drive," but later says that "The space required for 200 to 400 tons of coal is available in addition to that space at present allotted for dynamo room." The writer is unable to agree with either of the above views, first, because the total weight of machinery necessary for electric driving is less than that required with steam alone; and secondly, because it seems improbable that, with the pressing demand for greater steaming radius, any coal space will be given up to machinery, even though the coal consumed by auxiliaries is reduced. If the relative weights of equipment for steam and electric driving are necessary as above stated, it may well be feared that the introduction of the electric motors and dynamos for the work is to be a slow and uncertain change, but it can easily be shown that such is not the case. The solution of this entire question, the proven efficiency and reliability of electric driving being granted, depends directly on the test of weight for the electric and steam equipment, and by this test the future applications of one or the other must be largely decided.

The weights usually quoted in matter on the subject of electric driving are for engines and dynamos of about the same construction as is common in those machines for use on land, in which cast iron is largely used, a metal having less than one-half the value of wrought iron and steel in strength and magnetic properties. The extended use of cast iron in the main engines and other machinery of warships ceased to be good practice some years since, and there is no good reason why driving engines for dynamos and electric motors should not be constructed with special view to light weight for use on shipboard. The great weight of electric equipment and its driving engines on board warships is probably due to the fact that while the main engines and machinery in war vessels are usually built on plans of the government engineers, or under their rigid specifications as to materials and weights, the electric equipment has been substantially the same as that in common use on land as to materials and construction. It is true that the navy regulations limit the weight of engines and connected dynamos complete to one-third of a pound per watt of output, or $746 \div 3 = 248.6$ pounds per horse-power output; but this specification amounts to but little, as manufacturers can ill afford to make generating sets heavier than this, since even cast iron is costly in large quantities. When upward of $500 per ton is paid for armor plate, main engine shafts are forged hollow, and all the general machinery in warships is designed for the required strength with minimum weight, there seems no good reason why electric equipment should not be required of the smallest weight consistent with the best results, without regard to any slight increase in cost. The truth, perhaps, is that electrical machinery being of comparative recent use in the navy, has not received that attention from government engineers that has been given to other branches. The efficiency of electric equipment for driving auxiliaries on warships has been placed at higher figures, but the writer believes the following to be as good results as could regularly be attained in practice.

Combined compound engines and dynamos may be expected to have an efficiency of about 80 per cent. if worked at nearly full load, and electric motors and conductors also 80 per cent. under at least three-fourths full load. Above efficiencies give for the ratio of power delivered by motors to the indicated horse-power of engines, as $0.8 \times 0.8 = 0.64$, or 64 per cent.

Any good compound engines should develop indicated horse-power at the rate of 1 horse-power on 20 pounds of steam per hour, and an allowance of 25 pounds steam per horse-power hour, in consideration of some underloading and other losses, is liberal. At an average of 25 pounds of steam per indicated horse-power hour, and a combined efficiency of 64 per cent., the steam consumed per horse-power hour delivered by the electric motors is found by $25 \div 0.64 = 39$ pounds, or only $39 \div 119 = 0.328$, or about 33 per cent. of the steam required for steam-using auxiliaries in the Minneapolis test. Stated in another way, the electric equipment would save $119 - 39 = 80$ pounds of water per horse-power hour delivered at the motors. Taking the capacity of auxiliary equipment in a battleship at 2400 brake horse-power, it may be safely assumed that not more than one-half this auxiliary capacity will be in use at any one time, or 1200 horse-power delivered. With line and motor combined efficiency at 80 per cent., the power required from dynamos will be $1200 \div 0.80 = 1500$ horse-power, and that from engines $1500 \div 0.80 = 1875$ horse-power, combined engine and dynamos efficiency being 80 per cent.

At the government limit of 248.6 pounds per horse-power output from dynamos of generating sets, the weight of engines and dynamos to deliver the 1500 horse-power will be $248.6 \times 1500 = 372,900$ pounds. The weight of medium-speed motors, as commonly made, may be taken at 100 pounds per brake horse-power output, so that the total weight of the 2400 horse-power for auxiliaries will be $2400 \times 100 = 240,000$ pounds.

The weight of steam engines driving auxiliaries in warships will probably average 125 pounds per brake horse-power, and in many cases they exceed this figure. The weight of 2400 horse-power engine capacity at 125 pounds per horse-power is $2400 \times 125 = 300,000$ pounds for the steam drive.

Summing up above weights, the following results for a ship plant to deliver 1200 horse-power to auxiliaries aggregating 2400 horse-power total capacity:

	Pounds.
Total weight engines and dynamos to deliver 1500 horse-power	372,900
Total weight electric motors	240,000
Total weight of electric equipment	612,900
Total weight steam drive for 2400 horse-power	300,000
Excess of electric equipment over steam engines	312,900

All comparisons between the machinery required by the two systems that have come to the writer's notice stop at the point just reached, and thereby overlook a very important factor in total weight.

It has been shown above that the saving of the electric over the purely steam drive is 80 pounds of steam per hour for each horse-power delivered to auxiliaries, so for 1200 horse-power delivered to auxiliaries the hourly saving in steam with electric driving is $80 \times 1200 = 96,000$ pounds. A low figure for the weight of boilers and attachments is 5 pounds per pound of steam per hour capacity, so that the boiler equipment for the 96,000 pounds steam required by direct steam driving over that for the electric is $96,000 \times 5 = 480,000$ pounds additional. As the total boiler capacity necessary for the main engines must be had at the same time the total boiler capacity for the auxiliaries is wanted, the total boilers in the ship must be the sum of these two and the 480,000 pounds in boiler capacity above mentioned can be omitted with electric driving. A proper amount of feed water must be carried for the main engines in addition to that for auxiliaries, so that the 96,000 pounds of feed water required by direct steam driving over the electrical per hour may also be omitted from the ship, since water would not be returned to boilers more than once per hour. Taking these weights of boiler plant and feed water saved by the electric system in connection with the figures above found gives the following:

	Pounds.
Weight of steam driving of 2400 horse-power capacity	300,000
Extra weight of boilers required	480,000
Extra weight of feed water required	96,000
Total for steam driving not required in electric	876,000
Total for electric driving	612,900
Saving in weight by electric driving	263,100

From this it is evident that electric driving, instead of being so heavy, compared with direct steam as to forbid its introduction, actually effects a saving in weight equal to a large part of that of engines in direct steam driving. But the comparison is not yet complete, since the weights stated above for the electric system are based on those common in land plants, and it is by no means necessary or desirable to use such heavy machines on board ship as the present navy regulations allow. It is interesting to note in some detail by what constructions the weights of driving engines, dynamos and motors may be reduced. Compound engines, as now offered by most makers, weigh from 100 pounds to 150 pounds per indicated horse-power complete, including the extended bases to receive dynamos. Frames, bases, and cylinders of these engines are mostly of cast iron, while crank shafts, connecting rods and piston rods are of solid forged steel or steel castings. The improved construction desirable for light weight involves the substitution of steel castings for cast iron in bases and cylinders on account of its greater strength, hollow-forged steel frames in place of cast iron, and hollow-forged steel crank shafts, connecting rods and piston rods for the solid steel forgings and castings now used for these purposes. The lighter construction of connecting rods, piston and piston rods, makes the high rotative speed so desirable for dynamos more easily attainable. The net result of such improvements on compound engines is to reduce their complete weight, with extended bases for dynamos, to 60 pounds or less per indicated horse-power.

A few engine-builders have made use of this improved construction for light weight, and with their general requirement for marine work there is no reason why this method of building should not become common. A good illustration of several of the features of construction is found in the drawings for new U. S. battleships Nos. 10, 11 and 12, shown in Commodore Melville's recent report. The weights of most electric generators offered for direct connection vary with different makers from about 100 pounds to 150 pounds per kilowatt, or from 75 pounds to 112 pounds per horse-power output at the brushes.

Many of these dynamos for direct connection have cast-iron armature spiders and magnet frames, which should be replaced in an improved construction for light weight by steel castings or wrought-iron forgings. The proportions of many dynamos offered for marine work should also be so changed as to shorten magnet cores and increase somewhat the per cent. of copper compared with iron, as in this way the total weight of many dynamos can well be reduced. With the improvements above indicated the total weight for direct-connected marine generators may be readily reduced to not more than 75 pounds per kilowatt, or 57 pounds per horse-power output at the brushes. Seventy-five pounds per kilowatt output by no means marks the ultimate of improvements in the matter of weight, but is an actuality of material already attained by some large makers in their regular machines. Improvements to reduce the weight of small and medium-sized motors, as in the case of large dynamos, is to be attained by the substitution of steel castings and wrought-iron forgings for cast iron, and in this way a weight of not more than 75 pounds per brake horse-power capacity can easily be attained, and has, in fact, been surpassed in a number of cases.

With an efficiency as above of 80 per cent. for the engine and electric generator combined, for each horse-power of electric energy delivered at the brushes the engine must develop $1 \div 0.8 = 1.25$ indicated horse-power. The weight of engine per horse-power delivered at the dynamo brushes will therefore be from the above $1.25 \times 60 = 75$ pounds, and with the weight of dynamos at 57 pounds per delivered horse-power, the complete weight of generating set is $75 + 57 = 132$ pounds per horse-power of electric energy, or $132 \div 746 = 0.17$ pound per watt output at brushes, instead of 0.33 pound per watt; or 248.6 pounds weight per horse-power output at dynamos as allowed by the navy limit. That these reduced weights are not too low is shown by the fact that they are slightly bettered at this time by makers who have adopted the improved constructions above indicated in some sizes, while at least one large manufacturer who still uses cast iron for engine bases, frames and cylinders, offers regularly for marine work generating sets weighing about 160 pounds per kilowatt, or 120 pounds per horse-power output at the dynamo brushes. With the improvements above outlined fully carried out, there seems no reason to doubt that the regular weight of combined compound engines and dynamos for marine use can be reduced below 100 pounds per kilowatt, one-tenth pound per watt or 75 pounds per horse-power output of electrical energy at the dynamo brushes.

Basing weights of electric-plant equipment for a first-class battleship on actual attainments, as above pointed out, instead of the more common practice and the navy limit, the weights of electric driving will be as follows:

	Pounds.
Weight engines and dynamos to deliver 1500 horse-power equals 1500×132 equals	198,000
Weight 2400 horse-power capacity electric motors equals 2400×75 equals	180,000
Weight of driving engines, dynamos, and motors equals	378,000
Weight of 2400 brake horse-power steam engines equals 2400×125 equals	300,000
Weight of extra boilers required as above found equals	480,000
Weight of extra feed water required as above equals	96,000
Steam driving equipment not required by electric equals	876,000
Electric driving equipment not required by steam equals	378,000
Saving in weight by the electric equipment equals	498,000

Instead, therefore, of the prohibitive weight, or one two and a half to three times that necessary for direct steam drive, electric driving actually saves a weight of total equipment greater than the total weight of small engines used for auxiliaries without electric equipment. It will be noted that above figures for the saving in weight do not include the difference in coal burned by steam and electric driving, though to be entirely fair to the electric system this should be considered, the reason for omitting the weight of saved coal being that it seems hardly probable that the amount of coal will be reduced, even though some is saved from auxiliaries, as there is great need of more for main engines than it is at present possible to carry, since much of the value of a battleship depends on the distance she can travel at a given speed without recoaling. There is, however, one particular in which the weight of coal saved by use of electric driving must be considered—namely, its cost, as this has a direct bearing on the possible saving with the electric equipment. The electric plant will perhaps cost more than the direct steam system, and it should be noted whether the saving in coal offers a suitable inducement for the increased investment.

One writer has said that "The first cost of the electric system would be about three times that of the steam system," and that "The electrical system could not be expected to pay for its increased first cost in less than five or six years of constant use." How accurate are these statements may appear from the following: The use of auxiliaries in ships is intermittent, but from the best data at hand an average use of one-fourth their total capacity for twenty-four hours daily seems a fair estimate. Direct steam-driven auxiliaries of 2400 horse-power capacity, on the basis of one-fifth average load during twenty-four hours per day, consume, at the rate found in the Minneapolis test, steam to the amount of $(2400 \div 5) \times 24 \times 119 = 1,370,880$ pounds daily, which at 8 pounds of steam per pound of coal burned, requires $1,370,880 \div 8 = 171,360$ pounds, or $171,360 \div 2240 = 76.5$ tons of coal daily.

For electric driving, taking only 39 pounds of steam per horse-power hour at the motors as above, the steam consumed on the same assumption for average load is $(2400 \div 5) \times 24 \times 39 = 449,280$ pounds daily, which as above, amounts to $449,280 \div 8 = 56,160$ pounds, or $56,160 \div 2240 = 25$ tons of coal per day. The saving in coal for this case by electric driving is then $76.5 - 25.0 = 51.5$ tons per day, which at so low a price as $6 per American ton amounts to the sum of $57.5 \times 6 = \$345$. Cost of equipment for above electric plant on battleship may be fairly taken at the following figures:

Compound engines and dynamos to deliver 1500 horse-power at $50 equals	$75,000.00
Electric motors to deliver 2400 horse-power at $25 equals	60,000.00
Electric wiring and fittings for above equals	50,000.00
Total	$185,000.00

Direct steam driving requires 96,000 pounds more steam per hour than electric driving, as found above, and taking the cost of boilers and fittings at the low price of 50 cents per pound of steam per hour capacity, these additional boilers will cost $96,000 \times 0.5 = \$48,000$, and the 2400 horse-power capacity of small steam engines at $20 per brake horse-power will cost $2400 \times 20 = \$48,000$, making a charge of $10,000 for the extra steam-piping of direct steam driving, brings its total cost up to $106,000.

The total charge for electric equipment equals	$185,000.00
The total charge for steam equipment equals	106,000.00
Additional cost of electrical equipment equals	$79,000.00

Cost of fuel alone for the steam system was found above to be $345 per day more than that for the electric system, and this saving by the electric equipment amounts, therefore, to $345 \times 365 = \$125,925$ per year, so that the extra cost of electric system can be paid for out of the coal saved in about $79,000 \div 125,925 = 0.62$ year, or less than seven months. A just appreciation of the facts on which the above figures are based seems certain to result in the rapid adoption of electric driving for auxiliaries throughout the navies of the civilized world.

In spite of the great advantages as to weight and efficient operation inherent in the electric system for warships, the navies of the United States and of the world are slow to avail themselves of it. So far as the writer is informed, the first complete electric driver of auxiliaries is yet to be installed on a first-class battleship, and in most cases the electric system is confined to a few of the less important auxiliaries. To illustrate how generally steam is still used to drive battleship auxiliaries, the following data concerning the United States seagoing battleship Iowa have been taken from the account of her contract trial by Passed Assistant Engineer J. M. Pickrell, United States Navy, and printed in the Journal of the American Society of Naval Engineers of August, 1897.

The Iowa was contracted for at a price of $3,010,000, her length on water-line is 360 feet, beam 72 feet 2.75 inches, and displacement corresponding to normal draught 11,340 tons. On trial trip the Iowa's main engines developed 11,834 horse-power, and though the auxiliaries in use at that time developed only 236 horse-power, there is good reason to think that the total horse-power of auxiliary equipment is about 2500. Aside from the main engines there are eighty-four auxiliaries in the Iowa, with a total among them of 146 steam cylinders.

From the Minneapolis tests and the similarity of operation of auxiliaries on different warships, it is fair to assume that these 146 steam cylinders will consume about 119 pounds of steam per horse-power hour, instead of the 25 pounds to 40 pounds per horse-power hour that would be used in compound engines for the electric system. The electric plant of the Iowa includes four generating sets, each with capacity of 300 amperes at 80 volts, or 24 kilowatts, a total of but 96 kilowatts capacity for the four sets. Each generator is directly connected to a simple two-cylinder engine, each cylinder being 10½ inches diameter and 5 inches stroke, running at 400 revolutions per minute, and using steam at 80 pounds pressure.

Each generating set complete—engine, bedplate and dynamo—weighs about 8500 pounds, or nearly 35 pounds per watt of output. These generating sets supply current for about 500 incandescent lamps, four search-lamps, and the following electric motors: Two electric motors of 2 horse-power each are used to drive fans that ventilate the dynamo-room; four motors of ¼ horse-power each are used to drive portable fans which exhaust air from various compartments; eight motors of 7 horse-power each work the ammunition hoists in the 8-inch turrets; and seven other motors of about 5 horse-power each are used on ammunition hoists in other parts of the ship.

The Iowa, then, may well serve to illustrate the lack of electric plant and motor driving rather than what sound reasoning shows can and should be done in this direction. This high-grade seagoing battleship with modern armament, from her 12-inch guns down to those of rapid-fire; with an armor belt of Harveyized steel 14 inches thick, and with main engines triple expansion, and a water consumption of probably less than 20 pounds per horse-power hour, is using 146 steam cylinders for auxiliaries that are quite certain to consume more than 100 pounds of steam per horse-power hour.

The worst feature of these conditions is that they exist when it can be certainly shown by calculation and from actual plants on land that an electric equipment would do the same work with less than 40 pounds of steam per horse-power hour, and have less weight. Yet the Iowa has not been selected as a particularly bad example, but simply as a fair example of the great lack of electric power equipment in the navies of the world.

To sum up the case for electric driving in warships, the following facts are pertinent: The electric motor for hard and continuous work at all stages of load and overload, is in no way second to the steam engine, as shown by the tens of thousand of motors in use for electric traction under street cars, exposed to mud and water in all kinds of weather and to most severe overloads that would stall an engine in the same place and of equal rated capacity. Electric wires cut by shot in time of action simply put the apparatus to which they serve current out of use until the break is made good—usually but a matter of a very few minutes—while a steam pipe cut under the same conditions would be a serious menace to life in a close compartment, and would require much more time for repairs. Electric wires are so small and their temperature so nearly constant that they may be run about the ship with much less inconvenience and danger to other constructions, as men's quarters and water-tight compartments, than is the case with the much larger and hotter steam pipes.

For the same combined capacity of auxiliaries the complete weight of driving equipment from boiler to motor is less by a large percentage with electricity than with steam, as shown above. The electric system will deliver a horse-power hour to the driven machinery with less than four-tenths the coal consumption necessary where individual steam engines are used. The net result with the electric equipment, all other things being equal, is a lighter ship or greater coal capacity, a greater steaming radius or higher speed, and for ordinary operations in times of peace a material reduction in the yearly expense for coal. Of what value these features are to a great navy in peaceful maintenance or aggressive warfare, those whose positions impose the obligation may well decide.—*The Engineer.*

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NAVAL INSTITUTE PRIZE ESSAY, 1900.

A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1900. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

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7. The successful competitor will be made a Life Member of the Institute.

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