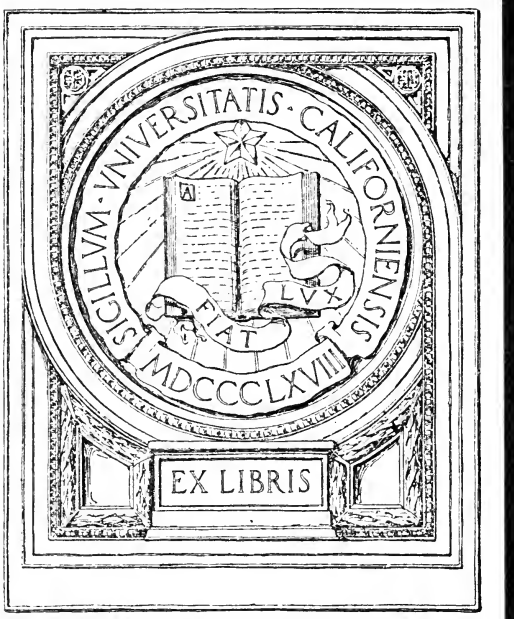
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NOTES ON RECENT OPERATIONS

JULY, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

WAR DEPARTMENT

Document No. 630

Office of The Adjutant General

WAR DEPARTMENT,
WASHINGTON, *July, 1917.*

The following notes on recent operations are published for the information of all concerned.

[350.05 A. G. O.]

BY ORDER OF THE SECRETARY OF WAR.

TASKER H. BLISS,
Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

WAR DEPARTMENT,
THE ADJUTANT GENERAL'S OFFICE,
Washington, June 19, 1917.

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By order of the Secretary of War.

H. P. McCAIN,
The Adjutant General.

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At G. H. Q., *14th May, 1917.*

[Appendix to the Information Bulletin.]

Translation of a German document.

INSTRUCTIONS—ARTILLERY FIGHTING ON THE SOMME—PART II.

STAFF OF THE 11TH A. C.,
H. Q., *Sept. 16, 1916.*

The artillery power of the English, as well as that of the French, continued to increase, as during the first month of the offensive. Each infantry attack was preceded by an efficient artillery preparation of very large and heavy caliber guns. Infantry attacks took place *immediately after the artillery preparation ceased;* simultaneously a large zone efficaciously covered by barrage fire on the terrain of attack prevented the bringing up of any reserves. The first attacking lines often escaped our (German) barrage fire; only our (German) infantry and machine gunners could deal with them; usually the last waves were efficaciously caught under our fire. When the enemy was able to penetrate our lines it was necessary to eject them by *energetic and rapid counter attacks.*

The ability of the subordinate commanders who found themselves in front consisted in being able to hold their troops well in hand in order to carry out these decisive counter attacks. A *delayed* counter attack wasted lives and time and usually had no effect. The enemy, by renewed attacks, engaged our supports. The enemy was able to gain success because our troops were hard pressed and were not familiar with the terrain.

The greatest attention should be given to the *observations by periscopes* in the first-line trenches. Complicated ap-

paratus are not necessary. A small mirror at the end of a stick is the best kind, but it is necessary that each observation post should have *a large number of these mirrors in reserve*, a single one being too quickly demolished by fire.

In all severe engagements in trench warfare the important point is to *determine rapidly* the position of our infantry in the first lines of defense during every stage of the action. This point must never be lost sight of. When the advanced troops change position, the colored panels (light brown on the side of the enemy) must also be moved.

Reports by telephone or sketch are at best incomplete. Photographs from balloon or, better still, from aeroplanes, have been successful in determining the position of the first line. For photographs, *the best way to indicate the positions* is by using strips of white canvas and the firing of magnesium lights, but the latter must be fired everywhere at the same moment, so far as possible, when they are called for by the balloon or aviators.

In determining a battery position be sure that it can still fire on the enemy if he penetrates our lines, and that it will not have a dead space into which the enemy can penetrate.

The material damage sustained by our field and heavy guns has here and there been so great that it is beginning to be difficult to replace the unserviceable parts, or those damaged by the enemy fire, especially the barrels. The guns' greatest enemy is not the enemy artillery, but our rapid fire and the small amount of care taken of the material. It is necessary that officers and men should take greater care of their guns than they have done up to the present. No gun barrel can resist a too prolonged barrage fire. Barrage fire must be rapid, but it must only last a *few minutes;* it should not be recommenced except in a case of need. (Note circular of chief of staff in the field Nov. 3, 1915, No. 17, 411 op.) There must be buckets full of water behind each gun, and wet, solid canvas to place on the hot barrels.

It is a false idea to think that demolished and unserviceable guns should be abandoned to the enemy; they must be *taken to the rear* as soon as possible, because certain parts of them can be used again. This also refers to machine guns and trench mortars.

In case of an enemy attack the artillery must *remain in position* to the last. When all the gun ammunition has been fired

the guns must be defended by means of carbines and hand grenades until an infantry counterattack can bring relief.

On the Somme, as well as at Verdun, our infantry complained of suffering *heavy losses from our own artillery.* It is absolutely necessary that this be remedied by auxiliary observers and by artillery liaison officers placed in the first line. Barrage fire must not be lifted and thrown forward on a hasty and ill-considered request of the infantry. It must be remembered that, even with a well-regulated barrage, some projectiles may fall in our own ranks. Consequently, only officers should carry signal pistols and the like. But, in general, it should never happen that our artillery fire falls destructively on and behind our line of infantry as a consequence of our artillery being badly informed as to the position of our first line.

During the fighting on the Somme the enemy aviators descended to within several hundreds of meters of the ground and swept our trenches with their machine guns. Our aviators must fight in the same way, with machine guns and bombs. They must practice this manner of fighting.

Signs showing the routes to known columns must be coated with a luminous color, otherwise they are useless in the dark. These routes must not be used except in important engagements, otherwise they are spotted at once.

The approach trenches must be laid out across places and woods which protect them from view and in which, during a lull, would be quite safe to traverse. It would be very difficult to do this after a fight.

It was found, during the fighting on the Somme, that cannoneers wearing masks at their guns had great difficulty in breathing. During periods of inaction frequent and progressive drills should accustom the cannoneers to serve the guns while wearing masks.

(Signed) V. PLÜSKOW.

GENERAL HEADQUARTERS,
May 11, 1917.

General Headquarters of the Armies of the North and Northeast.
General Staff.
Second Bureau.

[Appendix to the Information Bulletin.]

Translated from a German document.

INFORMATION ON THE BATTLE OF THE SOMME.

418th Infantry Regiment.

No. 133. Secret. MARCH 10, 1917.

This is compiled from information I gathered concerning the first army in the Battle of the Somme and which seemed to merit special attention. I submit it to the division commanders to be reviewed and acted upon.

What was done in the way of equipment (canteens), clothing (boots, foot bandages, socks), stores, close-combat weapons, maps, signal apparatus, boundary tapes? Form four sections of professional workmen (tailors and cobblers).

The machine-gun officer of the regimental staff takes charge of all supplies for the machine-gun companies.

Where are the depots? The supply depot of the regiment is in the engineer garrisons of the regiment. (For further details see Army Order, order 1/c, IV/a, No. 5,053.)

What are approximately the resources of the supply depots of the regiment?

Are the commanders of infantry battalions and engineer companies now in the rear, in readiness or in reserve, familiar with the terrain? Are the information sections organized?

Are the regimental commanders in touch with the barrage battalions of their sector? Are the troops supplied with signals for barrage fire, for destructive fire, and are they familiar with the instructions for their use?

Barrage fire: Yellow ball signal. Should only be given by one holding the rank of platoon commander or higher.

To lift the barrage fire: Green signal. To be given only by company commander or higher officer.

Destructive fire: Red star signal. To be given only by battalion commander or higher officer, and used only if the telephone is out of order.

Are the commanders of machine-gun companies in reserve familiar with their probable positions?

Limits of sectors of divisions, regiments, battalions, companies? They should never follow depressions, ravines, sunken roads, small wood, isolated farm.

How are reinforcements and supplies brought in? Accurate knowledge of the roads in the sector.

Do not simultaneously relieve the infantry and the machine guns of the first line.

Density of the first line (*experience on the Somme*), *one man for every 4 to 6 meters.*

Where are your immediate supports? (Immediately in the rear.)

How are the machine guns distributed? First line: In the rear of the first line (but preferably by sections). Flanking fire and mutual support.

For each machine gun of the first line, belts furnished with at least 3,000 rounds for each gun.

For each machine gun in the rear, belts furnished with at least 5,000 rounds for each gun.

Ammunition depots by battalion (if possible, by company). The machine-gun personnel should know where the regimental ammunition depots are situated. The machine-gun officer of regimental staff must see to this.

The improvement of the organization of the positions by a system of trenches developed in point of depth (front to rear) and in the form of a labyrinth, which gives a wide zone of defense.

When forming new positions first build the obstacle in front of the first line of combat, then dugouts in the second. Organize localities into supporting points. Determine on the garrison, designate the man in charge of the orderlies, of the clerks. Put the communication or approach trenches, at least on one side, in a state of defense; obstacles, dugouts.

Combats in and around the first line.

Reserves ready on time.

Build unceasingly new obstacles. Their destruction costs the enemy much in ammunition. Flank them with machine guns.

For the obstacles in the rear leave staggered passages for the counterattacks. The following works are specially important: The trenches in the rear should be supplied with the greatest possible amount of munitions, weapons for close combat, the greatest possible food supply (three rations per man), water, installation of kitchens.

Up to what line can the portable kitchens be brought? How food is brought up. The troops of the first line require hot food.

Dugouts for dressing stations. Wide passages.

Craters transformed into positions are inconvenient and should be improved. First make nests for snipers for one or two squads with one or two machine guns and surround them with wire entanglements; then connect them up in an irregular manner. The nearer they are to the enemy the less they are in danger from his artillery fire. That is the reason we prefer to prepare the craters situated in front, rather than those in the rear. Incessant work on the positions and efficient organization of the munitions and food supply keep up the morale of the troops.

To pass each other temporarily, advance; that is best.

It is not practical for troops to move to the side to avoid a wide zone of running fire.

If the enemy observes an evacuation, there is great danger that he will extend his fire and occupy the evacuated position.

To move to the rear is a fatal mistake, the terrain being under the heaviest fire and the troops being soon demoralized.

The French expect to take us by surprise; therefore extreme vigilance should be kept at the front, in all positions of readiness, in garrisons of supporting points, and in local garrisons.

Increased vigilance on dark nights.

Vigilance during foggy weather.

Immediate counter attack, without awaiting orders. For that purpose, proper distribution of all the troops in rear of the first line, in garrisons, and troops for counter attack (but not assembled in mass).

Guard against the incursions or infiltrations of small enemy detachments by saps, which, little by little, draw large detachments after them. Destroy immediately and systemati-

cally all such nests. Regarding immediate reaction and prepared counter attack, see "Experience of the First Army on the Somme." Use the Pioneers to the best advantage. Use light trench mortars for barrage fire. The battalion commanders are responsible for their use.

Where should the companies of trench mortars be placed in line? Asphyxiating bomb fire, destructive fire. Observe carefully. Distribute the companies of trench mortars at large intervals, echeloned in small groups in the terrain. Prepare ammunition in time.

General Headquarters of the Armies of the North and Northeast.

General Staff,
Second Bureau.
No. 12,620.

GENERAL HEADQUARTERS,
May 14, 1917.

HINDENBURG POSITION.

I.

THE WORKS RECENTLY EXECUTED RESEMBLE THE TYPE OF DEFENSIVE POSITIONS IN DEPTH APPROVED BY HINDENBURG.

In a survey of March 26, 1917, and according to information on hand at that date, the conclusion was reached that "the fortified position of Hindenburg presented, up to this time, a linear and regular appearance, without great depth, and which did not correspond to the regulations set down in Hindenburg's note of December 25, 1916, on the organization of fortified positions, in which he demanded the construction of positions of depth, with dugouts far from the first line, machine guns and obstacles scattered in depth and not regularly aligned on the front."

From information received since then the conclusion is reached that the so-called Hindenburg position becomes more and more an organization of great depth.

In March only the first position was near completion; the Germans rushed work to finish it.

At least several positions are known to be in course of construction north of the Oise; they are echeloned in rear of the first position to a depth varying from 10 to 15 kilometers.

II.

DETAILS OF ORGANIZATION AND CONDITIONS OF THE WORKS.

Hindenburg's system of defensive organization seems to include—

First. The plan of two positions out of the enemy's direct sight, one on the descending slope away from the enemy, the

other on the ascending slope, flanking the first from above and covering the artillery observation posts.

Second. A series of positions intended to form, with the first two, a deep system, converted into a rather dense network of communicating trenches and bordered by wire entanglements.

According to the German orders of December 25, 1916, the whole should form a network with large links, when the attack, after having broken through a part of the network, is caught in the links that have resisted.

The positions in rear of the first two *seem*, as a rule, to be laid out, as far as trace and interior organization is concerned, like the second position, in the sense that they do not perhaps present an obstacle as deep as the first, but they are well supplied with dugouts.

It is quite possible that the positions will be doubled later, to form a series of consecutive systems similar to that formed by the first two.

Generally speaking, the works are more or less advanced, and their trace seems to be well defined. The first positions may be considered completed. The second positions are already completely laid out. The third and fourth positions are under construction; in some places they are only staked out.

Everywhere one finds they have taken pains to place the obstacles and to dig the dugouts before constructing the trenches. According to refugees, they intend to make the maximum use of the cellars in the village, reinforced by cement, and connected with each other by subterranean passages.

III.

ORGANIZATION OF THE VARIOUS SECTORS AT THE BEGINNING OF MAY.

(*a*) District between Lille and the road to Cambrai: In this sector there are three positions on a depth of 15 kilometers.

In rear of the above-mentioned Drocourt-Quéant line two positions appear to be in course of construction, one on the general front Cuincy (northwest of Douai) Goug-sous-Bellonne, and the other on the Waziers, Arleux, Sains-les-Marquion line.

It is interesting to note that owing to the construction of the cross trenches (already well advanced) Inchy-Villiers-les Cagincourt and Bouilon-Marquion the Drocourt-Quéant line and the Wajiers-Sains-les-Marquion line, can, one after the other, ex-

tend the Hindenburg position, the very important organization of the Moeweres district serving as a pivot.

(*b*) *District between Cambrai and the Oise:* In this sector there are four positions on a depth of 10 to 15 kilometers.

It is in this district that the organization in depth is the most evident, as four consecutive positions have been made out.

The first position has already been described in detail. According to latest information, it is almost entirely finished.

The second position now exists on the entire front; it passes Flesquiéres, le Pavé (north of Banteux), West Aubancheul, Le Cutelet, Mauroy, Magny-le-Fosse, south of Lenergies, Remancourt, Fermstilloy, Hombliéres, Regny, Sissy. Distance from the first position, 1,500 to 2,500 meters.

This position is protected along its entire front by wire. The trenches are almost completed, but the communicating trenches are shallow. A great many dugouts for the personnel, the machine guns, and trench mortars are finished or under construction.

The third position passes to the west of Cambrai (information obtained from returning refugees). It was found by aircraft from Lesdain, and follows the line of Estries, Fontaine-Uterte, Fonsomme, Fontaine-Notre Dame. Distance from the first position, 4 to 6 kilometers.

It is under construction. The trenches are not continuous. In only a few places it has a first line, and a supporting line, usually shallow. A line of wire runs along the entire front. Only a few dugouts are finished.

Finally, the fourth position passes to the west of Wallincourt and Malincourt, to the east of Montbrehain, to the southwest of Fresnoy-le-Grand, to the southwest of Montigney-en-Arrowceise, and ends on the Oise near Macquiny. Distance from the first position, 7 to 15 kilometers. On the east side of the Oise it is extended to Sains-Richaumont. This fourth position has not been completely photographed. It appears to be entirely discontinuous, shallow, and equipped only in places with wire.

Inside these positions—which may be called the principal ones—there are sometimes intermediate ones. For example, between St. Quentin and the Oise a position of this kind follows the Mezieres-sur-Oise, Ferme de Lonval line, and passes west to Mesnil-Saint Laurent.

(*c*) Forest of St. Gobain: Little is known about the works in the St. Gobain Forest. We only know that the first position is completed.

G. H. Q. of the North and Northeastern Armies,
General Staff,
Second Bureau.

At G. H. Q., *19 May, 1917.*

[Appendix to the Information Bureau.]

Translation of a German document.

NOTES ON THE WORK OF AN INSTRUCTION DIVISION.

21st Div. Inf.
Bb. No. 155. Secret.

H. Q. of the Div., *2 March, 1917.*

First. Infantry.—Organization of combat companies according to special instruction and equipment of the men. Only occupy each position as long as it is necessary to hold it. Study the defending garrisons, the hidden groups of machine guns, and the supporting points. Cover the artillery and observing stations after arriving at an understanding with them.

Second. The alarm in case of a gas attack or a serious alarm does not require a very considerable displacement of troops. Consequently troops are placed in fighting position during a calm period. A serious alarm must be quickly met by special orders, by the establishment of many advance posts, by the occupation of machine-gun shelters, etc.

Third. Counterattacks are made, whenever possible, by several columns in line and by enveloping columns. The advance must be made not only by communication trenches, but also on the open terrain. As often as possible commence by placing the special attacking troops in such a way that they will not be checked by our own obstacles.

Fourth. Groups of runners at intervals of 300 to 400 meters. No isolated men. Several groups commanded by a sergeant. Indicate the roads by means of transparent colored paper.

Fifth. The reserves must constantly make known the points they have reached. Thus only can the moment of their arrival and intervention in action be calculated.

Sixth. Auxiliary defenses must not be placed too near the supporting points, so as to protect the garrison from grenade

attack. It is important to dispose of the auxiliary defenses in such manner as to separate the attacking waves of the enemy into several fragments (chiefly in the zone situated between the two first positions) and to draw them, without their knowing it, under the fire of our hidden machine gun posts and supporting points. In this way the action of the enemy will be seriously weakened, even in places, annulled, and the support of the artillery greatly interfered with.

Seventh. MACHINE GUNS.—Light machine guns of model 15 have proved themselves to be particularly effective and easy to handle. (Mobile reserve of machine guns.) They use them in groups, particularly in the first position. The company of machine guns is posted behind them. The infantry (one or two groups) covers the hidden machine guns (center of resistance).

Eighth. LIGHT TRENCH MORTARS.—The effects of their bursting projectiles is excellent. Consequently these weapons are well adapted to fighting moving objectives and for barrage fire. They are echeloned in depths the same as the machine guns. They are under the orders of the battalion commanders, and, if circumstances demand it, the regimental commanders. Light trench mortars generally come into action with the barrage fire, abstaining from firing beforehand and disguising their ranging fire in that of the artillery. Covered shelters often are not available and it may be necessary to make use of substitute emplacements which are open but well masked. The mortars should be utilized in groups. They have barrage fire tables the same as the artillery. They should strengthen the barrage fire of the artillery on the particularly important or threatened points. Cooperation is necessary. If the light trench mortars are also used for demolition fire it is necessary before they join in the barrage fire that they should change their positions in order to be ready to open fire and to be efficaciously screened from the enemy artillery.

Ninth. GRENADE THROWERS.—For defense during calm periods place them at the disposal of the commanders of companies to execute demolition fire and to check the work on the enemy's trenches, etc. If the struggle becomes too violent, they are used by their own officers in groups or in sections, especially for barrage fire. They are used to make the barrage fire denser the same as the light trench mortars (echeloned in depth). In the attack place them in the first line or immediately behind it; advance them in three or four waves to harass every movement of the enemy, to bomb the depressions and communication trenches, etc.

Tenth. DIVISIONAL COMPANY OF TRENCH MORTARS.—They will be employed under the orders of the commanding officer of the division pioneers. The medium and heavy pieces will be especially used in *demolition fire* against the observation posts, the machine-gun shelters, the shelters for the troops, and the tanks, etc. The trench mortar fire is also used to fire on the sectors which are to be subjected to barrage or annihilating fire. Once engaged in action, the company is at the disposal of the commander of the sector, under whose orders it fires. Its fire must be coordinated with that of the artillery. Mutual understanding is necessary. Graphic tables of barrage and annihilating fire must be made. In executing certain duties (preparation of counter attacks) the company will sometimes be under orders of the commander of artillery (by special order of the division).

Eleventh. *Fire on aircraft with machine guns* is carried out at the same time by several groups of machine guns, which will change their place immediately, in order to screen themselves from the fire which will be directed against them by the aeroplanes.

Twelfth. COMMUNICATION.—The commander of the combat battalion will establish *communication by visual signals*, not only with his own regiment, but also with the combat battalion of the adjoining sector, profiting by the rare moments which present themselves. With this aim in view, agree on a small number of important signals, for example, "All is well," "Annihilating fire demanded," etc. Signal panels, well stretched out, should be used, giving the aircraft *clearly marked outlines*, in order to make them easily recognizable (canvas on wooden frames) and in order that the aeroplanes may easily distinguish mine craters, water holes, etc.

FINAL REMARKS.—*The defense is strongly reenforced by trench mortars, grenade throwers, and light machine guns.*—Barrage fire must not be looked upon as the only means of repulsing an attack, but the *excellent defensive arms of the infantry* should be used normally and thoroughly. Furthermore, confidence must be developed in rifles, grenades, bayonets for hand-to-hand fighting, as this is the latest and best method. For the conduct of the fight and the occupation of posts under heavy artillery fire of the enemy, see the corrective plan of the defensive battle sent in on March 1.

S. WENDORFF.

MARCH 3, 1917.

General Headquarters of the Armies of the North and Northeast.
General Staff.
Second Bureau.

GENERAL HEADQUARTERS, *14 May, 1917.*

[Appendix to the Information Bulletin.]

Translation of a German document.

HOW THE ARTILLERY MAY ESTIMATE THE TIME WHEN THE ENEMY INFANTRY LAUNCHES ITS ATTACK.

APRIL 16, 1917.

Group of regiments of field artillery.

THE ORDER OF THE DAY TO THE GROUPS OF REGIMENTS OF FIELD ARTILLERY.

I call attention to the fact that, according to the new procedure of attack of the French, the task of destroying the artillery devolves, the greater part of the time, on the heavy artillery and that of medium caliber, by intensive fire. The enemy proceeds at the same time with the destruction of obstacles and defensive organizations by means of mines, plunging fire, and guns of small caliber.

When he considers these two objects have been attained he then begins the attack. It is at this time, as a rule, that he uses intensive fire with his heavy and medium caliber guns in order to support the infantry attack immediately, and with the available batteries of small caliber (75 and 105) he tries to destroy that part of the artillery that he does not believe to be entirely disabled.

The cessation of the bombardment by the guns of medium and heavy caliber is consequently a good indication that the enemy passes to the attack. This point must not be lost sight of by anyone connected with the battery, from the battery commander to the youngest gunner. Taking into consideration that the infantry can not recognize the moment of attack because of the progressive advance of the enemy fire, and consequently

that we can not count upon any signal for barrage fire, we must begin our own barrage fire at the moment indicated above, and immediately use all our forces and guns capable of being fired. Every available man jumps to the guns and executes barrage fire to the fullest capacity of the pieces.

Each officer and each soldier connected with the battery should realize from the above that at that moment our success or failure and the issue of the entire battle may depend upon his acting with initiative and self-sacrifice. The batteries which have not observed a change of caliber in the enemy artillery fire or that are still under its fire should also take part in the barrage fire of the other batteries. We can be sure that enemy infantry which has ever been subject to our annihilating and destructive fire and still retains the memory of its effect will not leave its trenches if at the right moment we drop our barrage fire on it.

All the gunners should be informed of this order.

(Signed) BURDE.

General Headquarters of the Armies of the North and Northeast.
General Staff.
Second Bureau.

At General Headquarters, *May 14, 1917.*

[Appendix to the Information Bulletin.]

Translation of a German document.

LESSONS TO BE DRAWN BY INFANTRY FROM THE COMBATS OF THE RIGHT BANK OF THE MEUSE.

Plushon groups.
No. 810.

Staff of the XI Army Corps, *March, 1917.*

The reports of the army group of the Imperial Crown Prince have the following lessons for the infantry from the failures at Verdun:

All infantry officers should be clear in their own minds of the exact manner in which they desire to conduct an active defense by infantry. They should prepare themselves by drills in typical defense works (the lines may be shown by means of white ribbons). The adopted method should be one familiar to the infantry and artillery, as the cooperation of the artillery, the intelligence service, and aviation corps are of the greatest importance in actual combat. This requires practical exercises and criticisms on the terrain and the map. The artillery officers concerned should attend.

It is not the material strength of a position but the skill and spirit of the defense that repels an attack.

The posts of infantry officers, including the brigade commanders, are on the battle field, in a position where they can personally control the tactical situation without being dependent on their telephone connections. They should choose their post so as to have their reserves immediately at hand, and they should transmit to their reserves such combat orders as their own knowledge of the terrain and tactical observation dictate. As

means of communication between themselves, couriers may also be used, according to circumstances, and shelters must be provided for them. A position well echeloned in depth on the flanks, close communication, and cooperation in the fight with the neighboring troop should prevent any bending back of the flanks of the sector.

I request the division to notify me whenever any practice of active infantry defense takes place. I desire that the infantry commanders, from the brigade up, should ascertain from their staff officers whether the measures of defense correspond with the above.

I shall expect a report on this matter by March 27.

The commanding general.

(Signed) KUHNE.

183d Div. III. 645. Secret.

DIVISIONAL HEADQUARTERS, *20 March, 1917.*

The brigade will select and organize a command post corresponding as nearly as possible with the requirements expressed above. The command posts of the regiments and of the battalions will be again inspected. Whenever they are found not to meet with the above requirements, others must be immediately constructed. They must make sure to find the regimental C. P.'s with C. P.'s of the subordinate groups of artillery whose batteries execute barrage fire in the sector of the regiment.

The brigade will submit a report by the 26/3 on this subject, and on the state of advancement of the work.

The infantry exercises of active defense, executed by the battalions in billets and by the reserves (where such exercises can take place) must be reported to the division two days in advance in the evening report. Each company in billets should, during its rest period, execute at least one active infantry defense, using the model defensive work.

Translation of a German document.

EXPERIENCE OF THE RECENT FIGHTING AT VERDUN.

GENERAL HEADQUARTERS,
25 December, 1916.

Chief of the General Staff of the Field Army.
II/Ia. Nr. 42728 op.
Secret. T.40.
Not to be taken into the trenches.

The serious and regrettable reverses sustained at Verdun during October and December have led me to issue the following orders:

1. CONSTRUCTION OF DEFENSES.

The principles laid down in the textbook "Construction of Defenses" (*Stellungsbau*) have proved sound. Single *lines of trenches* do not suffice. *A fortified zone must be constructed, organized in depth,* allowing of a stubborn defense of an area even after the capture of fragments of its lines of defense.

The rearward portion of this zone will, therefore, consist of a system of strong points, machine-gun nests, etc., merging toward the front into an increasingly closer meshed network of trenches. The individual trenches, machine-gun nests, etc., must afford each other mutual flanking support.

Deep mined dugouts in the front-line trench will be absolutely prohibited. They simply form man traps and will, therefore, be blown up wherever they exist. The place for the majority of the dugouts (which should be of concrete and be well distributed and masked) is in the rearward lines and in the intermediate zone. Vast subterranean accommodation is only admissible for reserves far in rear.

Of greater importance than a wide *obstacle* covering the front-line trench, which will, in any case, always be destroyed in a serious attack, is the construction of a *number of obstacles* within the fortified zone, namely, along the communication and switch trenches, and farther in rear, forming a part of the

strong points. These obstacles form the meshes in which an enemy who has broken through is caught, and which prevent him from surrounding the portion of the garrison which has held out in the front line.

Difficulties will be added to the enemy's reconnaissance and artillery work by the construction of the greatest possible number of targets and by making them difficult of recognition (also of dummy defenses).

At Verdun, where there were too many dugouts in the front-line trench, a proportion of the infantry did not get out of them quickly enough. A close-meshed network of trenches was lacking, as were also obstacles running perpendicular to the front.

2. OBSERVATION.

Observation both for artillery and infantry must be assured even under the heaviest fire. This is not the case when, as at Verdun, observation is mainly carried out from the front-line trench. It is preferable to construct a network of observation posts located at points in rear. The view from one post must supplement that from another.

In addition, constant observation of the enemy's activity, from balloons and by artillery and infantry aeroplanes (contact patrols), must, of course, be absolutely guaranteed.

Finally, one must insist that infantry quartered in deep dugouts and shelters protect themselves effectually against surprise attacks by posting lookout men and by frequent visiting rounds. The large number of unwounded prisoners shows that this was not properly done.

3. METHOD OF HOLDING THE POSITION AND THE INFANTRY BATTLE.

As pointed out in the "Defensive Battle" (*Abwehrschlacht*)[1] (see more particularly pars. 6, 13, and 15), a stubborn defense alone will not lead to the desired result.

The front-line trench can not be too thinly held. Distribution in depth is essential, even for a company. Each strong point must have its definite garrison, which will be responsible for holding it.

[1] Not yet captured.

Only isolated *machine guns* will be taken into the *front-line trench;* they will usually be kept in carefully selected positions behind the front line, concealed and posted checkerwise, frequently in hollows, which are difficult to detect from the air and can not be reached by the artillery; their main task is to open a surprise flanking fire on an enemy who has broken through. The operation of bringing machine guns into position and relieving them will be specially supervised.

Reserves must also know their way about the sectors of the divisions on their flanks. When fighting conditions permit, a certain tactical situation will be assumed, schemes will be set, and maneuvers carried out over the actual ground. Tactical work in the front-line position and tours of inspection must be exacted from senior officers, from the battalion commander to the higher commander or the latter's staff officers. In certain circumstances, the regimental commander, just like the battalion commander, must personally lead forward his reserves. No one, from the counter-attacking squads of the front-line garrison down to the divisional reserves, is to wait for orders to counter attack, but each will *act on his own initiative.*

During *training* the following must be practiced and supervised:

The counter attack, from that of the counter-attacking squads of the front-line garrison to that of the larger reserves.

The measures to be adopted by the front-line garrison, while awaiting the counter attack of the formations in rear, against an enemy who has broken through and is surrounding this garrison.

The action of the emergency garrisons posted in machine-gun nests and strong points.

At Verdun these arrangements partially broke down. Units in rear showed a lack of offensive initiative. Portions of the foremost fighting lines, which were gallantly holding out, were left in the lurch by those in rear and fell victims to the enemy.

4. THE ARTILLERY BATTLE.

As in the preceding case, if proper arrangements are made for the battle, the enemy's attack can be anticipated.

Nevertheless, at Verdun, artillery support appears to have been lacking.

It is not quite clear to what extent the enemy's artillery was engaged by our own. To engage the enemy's artillery (with the help of aeroplane observers) is, however, the principal and most effective means of fighting a defensive battle to a successful conclusion. Should this succeed, the enemy's attack is absolutely paralyzed.

When the enemy's infantry attack is imminent, fire must be more and more concentrated on the enemy's infantry as well.

In so doing, it is not advisable to direct a destructive fire on successive portions of the enemy's position chosen arbitrarily. Fire will preferably be directed on points where work is in progress and where effect against living targets may be expected. The same holds good for harassing fire, for which, in certain circumstances, gas shells are particularly effective.

For both kinds of fire, observation and supervision are the main factors for obtaining effective results (see above).

The destructive fire to be directed on the enemy's front-line trenches will be increased, both as regards the number of batteries engaged and the expenditure of ammunition, in proportion to the increase of the enemy's fire on our infantry lines. It will be increased to annihilating fire as soon as a maximum rate of fire on the part of the enemy, or other signs, denote that the attack is about to be launched. From this time onward the mass of the artillery, even including the 21-centimeter mortars, will concentrate fire of the utmost intensity on the enemy's starting points and assembly trenches, so as to annihilate the troops held in readiness for the attack before they can move to the assault. Arrangements must be made for annihilating fire to be broken off like barrage fire, but, in any case, only on receipt of an order from a senior officer (battalion commander).

During these short phases of the battle there is to be no thought of economizing ammunition.

This procedure does not debar *individual* batteries from simultaneously continuing to sweep valleys and ways of approach, so as to prevent reserves from being brought up. At such moments, also, it is advisable to neutralize sections of the enemy's artillery by using gas shell.

It is the duty of all artillery commanders to acquire a practiced eye and ear and to utilize every means of reconnaissance and observation to gauge accurately the moment at which the maximum intensity of fire should commence. In no circumstances should this increase of fire take place only when the

infantry ask for barrage fire, as, in that case, the most effective period for engaging the enemy's infantry, the period of assembly, is missed. On the other hand, the duration of annihilating fire will, naturally, always be strictly limited.

When the enemy's attack is launched, barrage fire will finally be opened automatically. Barrage fire is purely a means to repel an attack. The artillery must, however, assume the offensive not only against the enemy's artillery but also against his infantry. Acting on their own initiative, artillery of all calibers and also the *Minenwerfer* will devote their main strength to seeking and engaging the most favorable targets and not merely to putting up a purely mechanical barrage.

Well-organized barrage fire, important as it is, does not necessarily by itself afford absolute protection. The enemy may either run the gauntlet of our barrage or else draw it before the attack, and, at the decisive moment, endeavor to neutralize it by opening fire with gas or high-explosive shell. Or, again, he may make a detailed study of the lie of our rather mechanical barrage, with the result that he will find points which are less heavily shelled than others and will make his way through them with few casualties.

It thus follows that the barrage must be flexible, i. e., it must be mobile so as to correspond to the probable movements of the enemy.

Observation and fire control (cf. par. 2) must be also aimed at during the annihilating and barrage fire. This will generally be achieved by transforming automatic and spontaneous unobserved fire as soon as possible into observed fire. For this purpose it is often possible for the aeroplane observer to fly at a low altitude, far behind our own line, and as though perched on a giant observation ladder, and communicate with the batteries in action not only by wireless but by means of the simplest signals. Only thus will it be possible to engage fleeting targets and to punish immediately any imprudence on the part of the enemy—batteries moving across the open, infantry advancing or concentrating without cover.

But even making allowances for considerable improvement in our artillery work, the infantry must clearly understand that artillery can only relieve them of a part of the defense, and that, finally, it is the infantryman who has to repulse the enemy at close quarters with machine gun, rifle, hand grenade, and trench mortar.

5. ARTILLERY COMMAND.

The long ranges, combined with the difficulty of obtaining a general view of the country, necessitate the general allotment of targets and fire control being carried out by the higher command, from the group of armies downward, even for artillery under divisional commands. The higher commanders must issue precise instructions for the artillery battle and must not hesitate to go into details when it is a question of cooperation between neighboring sectors. The division, for its part, must *daily* define the tasks for its artillery. (See par. 23 of the "Defensive Battle.") Fire-control practices must constantly be held. If, in addition to the issue of precise orders, there is a thorough supervision of the work of all grades (down to and including the observers), the artillery will prove equal to its task.

6. RELIEFS.

Timely relief is very important (see the "Defensive Battle," pars. 9 and 18); it can only take place gradually and requires the most careful preparation. The infantry has frequently, for example, to relieve the unit farthest in rear, and then gradually work forward until the front line is reached. Regiment must hand over to regiment, and battalion to battalion, etc. The outgoing commander may only leave the position with the consent of the commander who is relieving him. This method should insure that during the actual relief there is always one unit in the position which knows the ground, and that the incoming unit gradually obtains a knowledge of the position.

The relief of artillery, other than divisional, demands special attention, and experience shows that this matter often receives less consideration.

During pauses in the fighting, batteries belonging to armies and groups of armies must be withdrawn, which will also give them an opportunity to overhaul their material.

The same principle holds good for pioneers and other auxiliary services.

7. MORALE, CARE OF TROOPS, AND SUPERVISION OF COMMANDERS.

The number of prisoners (which was unusually large for German troops), some of whom evidently surrendered without offer-

ing serious resistance and without suffering heavy losses, shows that the morale of some of the troops engaged was low. The reasons for this require most careful investigation. The whole spirit of the German infantry must be revived by means of training and the strictest drill, as well as by educating and instructing the men. It is a matter of vital importance to our Army that the proper steps be taken.

This question is closely allied to that of looking after the troops in regard to clothing, food, and quarters, adjustment of work and rest, equitable allotment of leave, as well as the personal example of all ranks. I particularly wish to emphasize the fact that under the extraordinarily difficult fighting conditions at Verdun, this latter point is just as important for fighting efficiency as are correct tactical decisions.

The supervision of officers, particularly of the more senior officers, must be searching, and the above-mentioned matters must also be taken into account. Any officer incapable of doing his work will be summarily removed from his post. Long leave, given in time, will frequently suffice to enable officers suffering from nervous strain to recuperate and return to their work.

8. TROOPS AT REST.

Troops which have been withdrawn must be given facilities for rest and training. The necessity for bringing them up to dig trenches is an evil which can not be completely avoided.

Training and inspections alike must reflect the spirit of the foregoing. The attack will also be practiced by higher formations.

As remarked in paragraph 7, training for battle is not sufficient by itself, but must be combined with drill. The experience of war confirms the principles of our peace training.

(Signed) v. HINDENBURG.

PRÉCIS OF AN ARMY ORDER ISSUED BY THE GERMAN FIRST ARMY.

An order issued by the German first army, dated 11 January, 1917, with reference to the above, lays stress on the following points:

(*a*) *The garrison of the front-line trench* should be reduced to a minimum; one man to every 6 yards (see (*b*) below).

(*b*) Only a *few deep dugouts* should exist in the front-line trench, sufficient to accommodate a minimum emergency garrison. The scale should be one dugout every 55 yards, to hold a group (i. e., one N. C. O. and eight men) or two dugouts every 110 yards to hold two groups each. Larger dugouts to hold more than two groups will not be constructed in future in the front-line trench.

(*c*) *The existing dugouts* in the front-line trench should be *reduced* to the scale laid down above, by dismantling them, by nailing up the entrances, or by digging a new front-line trench in front of the existing one, where the enemy's line is not too close.

(*d*) *The depth of these dugouts* below ground should, if possible, be reduced by constructing them of concrete, steel, and girders. In no case may they be a greater depth than that required to provide 20 feet of earth cover.

(*e*) During an intense bombardment, *observation* will be effected from posts in rear of the front-line trench or by individuals momentarily issuing from the dugouts in that trench.

(*f*) *Strong, wide obstacles*, arranged checker-wise, must be erected in front of the second, third, fourth, etc., trenches of the first-line position, particularly in front of the deep dugouts; similar measures must be taken in front of the positions in rear.

(*g*) *Lookout posts* must always be manned even in the rear trenches and positions.

(*h*) *A trench* must be provided *in front of the deep dugouts for the supports;* this trench must be easily accessible and defended, and should be wired.

(*i*) *The emergency garrison* of trenches behind the front-line trench will not take part in counterattacks.

(*j*) *Machine guns* will be sited mainly outside the trenches, particular care being taken that all hollows running perpendicular or parallel to the front can be brought under fire.

(*k*) Every infantry commander must have *a reserve* at his immediate disposal, with which to counterattack.

(*l*) As soon as an attack is expected, all *supports and reserves* must be held ready under cover at the points where they are to be employed in counterattack or defense. They can not be formed up methodically, and in time, if they are only brought up after the enemy has attacked.

In the case of operations of some months' duration, the above-mentioned information must be constantly maintained, in spite of the hardships involved.

(*m*) Arrangements are to be made for switching *artillery* fire rapidly onto an enemy who has broken through. This can be done by direct laying or by fire control from a good viewpoint, which must be close to the batteries.

(*n*) *Single guns, sections, and batteries* will be pushed forward to open harassing fire, and these will also be employed against "*tanks*" as required.

GENERAL STAFF (INTELLIGENCE),
GENERAL HEADQUARTERS,
28 February, 1917.

SOME TACTICAL NOTES ON THE RECENT OPERATIONS UP TO 7TH APRIL, 1917.

I.

RIFLE BOMBS.

The following extract from the report of a company commander who has been engaged in the recent fighting is circulated as being of interest:

During the recent operations in the Serre-Bucuoy district the rifle bomb has proved very effective in dealing with machine guns which, in conjunction with wire, were being used to delay our advance, and which, unless knocked out very quickly, did considerable damage.

The rifle bomb, used in cooperation with the Lewis gun, riflemen, and occasionally bombers, has been the chief weapon, as it has been found that, provided cover can be given by the Lewis gun and riflemen, the rifle bombers can approach to within range and by a sudden and rapid barrage can knock the gun or team out, make it withdraw, or enable the Lewis gunners, riflemen, and bombers to advance.

It has been found that if the Lewis gun opens fire first the German machine gunner will almost invariably direct his attention to it, and, owing to the apparently limited traverse of the German machine gun, the rifle bomber can work around to either flank and get within range.

GENERAL HEADQUARTERS,
2 April, 1917.

II.

MACHINE GUNS AND LEWIS GUNS.

It is reported that during the recent advance on the Somme battle front advantage could not be taken of good targets owing

to the range being too great for Lewis guns to deal accurately with them.

This points to the advisability of some machine guns being placed well forward in an advanced guard to deal with fleeting targets. If so placed, they can also be used to hold important tactical points which may have been gained.

In this connection, attention is directed to "Notes on the Tactical Employment of Machine Guns and Lewis Guns" (S. S. 106), page 6, paragraph 4.

GENERAL HEADQUARTERS,
3 April, 1917.

III.

ADDITIONAL POINTS BROUGHT OUT IN OPEN FIGHTING UP TO APRIL 7, 1917.

1. CAVALRY AND MOUNTED TROOPS.—(i) Considerable success was obtained despite action being necessarily restricted.

(ii) Machine-gun fire, like shell fire, can be ridden through, if it is not intense, and provided no check is allowed to occur.

(iii) Turning movements should be made wide and in some strength.

(iv) Mounted attack by small numbers of cavalry on similar numbers of infantry was successful.

(v) During halts as much wire as possible must be cut to allow of room for maneuver.

(vi) A sound preconcerted plan for the cooperation of artillery and machine guns in the attack is most necessary.

(vii) When possible, long-range guns should be pushed forward in support of cavalry.

(viii) Supporting infantry should, when possible, keep liaison with attacking cavalry.

2. ARTILLERY.—(i) Teams of guns moved forward should remain at hand.

(ii) F. O. O.'s pushed well forward with telephones proved invaluable, as there was no hostile barrage to cut the lines.

(iii) Covering fire of 18-pounders and 4.5-inch howitzers can not be too far exploited.

(iv) There was a tendency, due to trench warfare, among C. R. A.'s to attempt to control individual batteries. Brigade or group commanders should be given a task and allowed to carry it out.

3. INFANTRY.—(i) Relentless pushing forward of patrols night and day to occupy points of vantage is the surest means of success. Patrols can not be too venturesome or too tenacious of ground gained. They must cooperate with one another along the front, if necessary covering each other's advance by fire.

(ii) A tactical point is not necessarily held in strength because a machine gun is located in it.

(iii) Fire from rifles, machine and Lewis guns to cover movement is as effective as ever.

(iv) In dealing with tactical points, including villages, the importance of combined action of all infantry weapons was clearly proved. Rifle grenades were used with great effect. The 3-inch Stokes mortars also proved most valuable. These, like machine guns, can not be used too far forward in an advance. If even 30 rounds only can be got up to the gun, its moral effect is often sufficient to induce the enemy to quit his position.

(v) Visual signaling is of utmost assistance.

(vi) An advance party of Royal Engineers is required well forward to reconnoiter for removal of obstacles left by the enemy. This party should be mounted on horses or bicycles.

(vii) Villages should usually be avoided. Their attack involves heavy losses and when occupied they become shell traps. They are better captured when possible by a turning movement.

(viii) The amount of personal activity required from an advance-guard commander is very great.

(ix) All ranks adapted themselves readily to open fighting, despite few opportunities for previous instruction.

GENERAL HEADQUARTERS,
10 April, 1917.

Headquarters of the Armies of the North and Northeast.
General Staff.
Second Bureau.

GENERAL HEADQUARTERS, *April 26, 1917.*

[Appendix to information bullentin.]

BATTALIONS OF ASSAULT.

(Based on the Provisional Regulations for the Instruction of Foot Troops in the Field, of January, 1917, and Information from Other Sources.)

I.

In General.

Battalions of assault have been organized in each army for the purpose—

1. Of facilitating the special preparation of the greatest possible number of officers and noncommissioned officers as instructors in the war of position and, principally, for close combat.

2. In order to work out further improvements in the methods of attacking fortified positions.

The battalions of assault are not merely instruction battalions, they are also combat units assigned to the execution of attacks in which the conditions of execution are particularly difficult. The instructors of the battalions of assault seem to have been trained in a common training center for all the theaters of operations (reports from the Russian General Staff). This training center is said to be near Longuyon in a special camp where training is carried out by Col. Rohr (mentioned in the exhibit herewith).

So far, up to the present, one or two battalions of assault have been identified with each army. These battalions had the same number as that of the army to which attached. But an order of the seventh army, dated 18 September, 1916, informs us that the battalion of assault of that army had been abolished on account of the constant renewal of the elements of that army.

The army corps then received the mission of themselves organizing battalions of assault on the same lines as the army battalion of assault (exhibit herewith). At present the battalion of assault is accordingly not only an element of an army, it may also be an element of any army corps.

II.

Organization—Composition.

The noncommissioned officers and privates who form a battalion of assault are specially selected. They are young, strong, single men, or married men without children. Sometimes even the more unruly or undisciplined men of the company are taken. (From statements of prisoners.) The drafts from some companies have amounted to 25 men. The best of them have remained with the battalion after a course of training, which lasts six weeks; the others are sent back to their organizations, where they form platoons of assault or patrols when needed to execute raids. Under certain conditions these platoons may be united into one company of assault by infantry brigade; the companies in their turn may form a battalion of assault for an army corps.

The composition of a battalion of assault varies. The following composition of the second battalion of assault of the third army is given as an example.

This battalion was commanded in March, 1917, by a captain assisted by a lieutenant. It was composed of four companies of assault, each of 100 men and 3 officers; one machine-gun company of 6 pieces (model 1908); one company composed of trench mortars and bomb-throwing machines (4 heavy and 4 light trench mortars); eight bomb-throwing machines, two bomb-throwing machines to throw winged bombs; one company of flame throwers (4 heavy and 4 light machines for making flames); one battery called an assault battery of 4 pieces (caliber 57 mm., i. e., 2¼ inches).

III.

Training.

It is both theoretical and practical.

(*a*) Theoretical Training.—Its object is to enable the officers and noncommissioned officers detached from their organizations to take advantage of the experience acquired in action.

This instruction concerns itself chiefly with the following points:

Instruction of the infantry, especially the groups of assault, in the methods of the war of position. Employment of the groups of assault and of the armament placed at the disposition of the battalions of assault. Cooperation with the infantry by all the special weapons of the battalions of assault during the attack. Besides, the noncommissioned officers and men must understand the effects of the German and foreign arms, the methods of liaison between the infantry, the machine guns, the trench mortars, the artillery, and all the means of close fighting in the offensive and defensive.

(*b*) PRACTICAL TRAINING.—Iron discipline, strong professional pride, great self-confidence mean success in assault troops even more than in any other troops. In every drill, in every duty, the object to be attained is to harden the body and stiffen the character. The noncommissioned officers must confront their men with confidence and bear themselves as superiors, with initiative in ideas and deeds. The troops of assault must be accustomed to all the methods used in combat.

Their training will be carried out on special ground. They are trained to perfection in trench fighting as well as in the management of German and foreign machine guns.

The different exercises comprise:

Throwing of German and foreign grenades;
Passage of various sorts of obstacles;
Destruction of barbed wire with cutters and explosives;
Use of automatic rifles and pistols.
Actual maneuvers with the use of flame throwers.

After a detailed training of the soldier, first individually, then in groups, drills are carried out with the simultaneous employment of all the arms used by the assault battalions in order to increase the men's confidence in each other and to assure in action an effective support and teamwork.

The following points are especially dwelt upon during training, making use of works made for the purpose and varying the details as much as possible:

Attack of an enemy trench;
Attack through several enemy lines and positions;
Counter attacks;
Cleaning up nests of the enemy;
Combats between machine guns and small strong points;
Repulse of enemy counter attacks.

It is recommended that these maneuvers be carried out with the infantry; if none are available, men can be taken from the assault battalion to represent them.

Experience acquired in action can be utilized in the organization of these maneuvers and to serve for the special instruction of the assault battalions.

IV.

EMPLOYMENT.

The assault battalion has its definite place in the scheme of a regularly organized attack. It is under the direct orders of the commander charged with execution of this attack. It is especially useful in the struggle for the possession of a fortified position, but these chosen troops also form a combat unit under many other conditions. At times it may be expedient to supply them with bicycles or to transport them by automobile.

When an assault battalion must be employed during a long-drawn-out action or in a counterattack it must be sent in advance to the sector where it will be engaged in order to avoid having its entrance into action delayed by preliminary reconnaissances and the long march through the approaches which it would have to make if it started from a rest camp.

The battalion of assault furnishes groups of assault to the infantry. It must avoid giving whole platoons or companies for this purpose in order to preserve all its combative power and to better utilize the individual valor of its men.

Before an attack the officers and group leaders of the assault battalion make the necessary reconnaissances with the infantry commanders.

They are responsible for the regular execution of the attack by the groups of assault.

Preparatory exercises carried out with the infantry, on a selected drill ground, increase the chances of success and give to the assaulting troops confidence, cohesion, and surety of execution.

During an attack the groups furnished by the assault battalion must lead the infantry at the difficult points. They make the breaches across the enemy trenches, destroy the machine guns and strong points, and aid the infantry in the organization of the conquered position. In their mission they are supported by the special armament of the assault battalion.

After the attack the battalion assembles all of its detached elements and becomes available for new duties. However, it must not be withdrawn from action except on the order of the infantry commander who directs the action.

V.

Equipment and armament.

The equipment and arms of the troops of assault have been prescribed in the appendix of the Information Bulletin of September 23, 1916.

VI.

Employment of the auxiliary arms.

1. *Grenade throwers, Model 1916.*—Some grenade throwers can be given to each group of assault. These can be placed either in immediate rear of the starting position or in the second line. A short time before the beginning of the assault they should throw their projectiles on the points where breaches are to be made, taking them obliquely, if possible.

2. *The light trench mortars.*—The light trench mortars are in battery in preference in immediate rear of the position from which the attack starts. They have the same purpose as the grenade throwers, model 1916.

3. *The light flame throwers.*—These pieces of apparatus have the special mission of facilitating the attack on the trenches and in attacking the small strong points of the enemy. In the attack of a trench they spray the parapet before the infantry moves forward, so as to prevent the enemy from defending himself. In the attack against a strong place the apparatus must be brought up as close as possible, and under cover, either on the flanks or in rear of the work. In order to reach it the defenders must be held down by a frontal attack of machine guns. The light flame projectors must be kept under the constant protection of the assault groups. As soon as the apparatus is in action the infantry must push forward at once to occupy the enemy trenches and exploit the success.

4. *Infantry guns.*—The rôle of the guns of the infantry is to attack either from the position which the infantry holds or from

places even nearer them, close the various positions that, either because of their small size or their location, can not be reached by the artillery at a great distance. These objectives are principally given parts of the trenches, cover for machine guns, flank defenses, posts of sharpshooters, observation stations, etc. Infantry guns serve also to repulse an assault.

5. *Other arms.*—The arms of heavier types which also are placed at the disposal of the assault battalion are employed, under normal conditions, which are already understood.

Translation of a German document.

ARMY ORDER.

VII Army, General Staff.

Pi.—No. 717.

Subject: Assaulting elements.

SECRET.

SEPTEMBER 13, 1916.

The frequent changes in the units which form the army, changes which one must expect to be even more frequent in the future, render it unfortunately impossible to longer maintain the integrity of the units of assault of the army. On the other hand, the special training for the "service of assault" is indispensable. The long duration of the war, the development of technical methods, the undeniable progress of the enemy infantry, and the difficulties which trench warfare impose upon the instruction of noncommissioned officers and privates, require the augmentation of the offensive force of a part of the infantry and of the engineers and the placing at the disposal of the commanders of units of a special force most carefully trained. This special training will henceforth be intrusted to the army corps.

Accordingly, in canceling the provisions of the order of the VII army II, 6 Pi 244, Secret, and Pi No. 10535, I order the following:

1. The assault detachment of the VII army is discontinued. Its quarters at Mons-en-Laonnois, its drill grounds and buildings, as well as its instruction matériel, as far as it does not belong to certain bodies of troops, are to be assigned at once to the First Bavarian Reserve Army Corps and will be employed by the assault detachment which will be formed by that corps (see par. 2). The First Bavarian Reserve Corps will report having taken it over. The officers, noncommissioned officers, and men will, as soon as possible, join their own units. They will take with them the property they brought with them. Capt. Munchau, commanding the assault detachment, will stand available for further orders on 16th of September, at the latest.

The officer placed in command of the assault detachment of the First Bavarian Reserve Corps is advised to communicate as soon as possible, in person, with the commander of the

assault detachment of the army, in order to acquaint himself with the experience which has so far been obtained.

All returns and papers of the assault detachment, including the route diary, and the orders and instructions received by it, must be sent to the Chief Engineer Officer of the Army.

2. The army corps will themselves organize assault detachments from the personnel which has already been trained in the assault detachment of the army, from officers, noncommissioned officers, and men taken from the companies of infantry, engineers, and minenwerfer (trench mortar) detachments. It is of utmost importance that this personnel be chosen with great care. The composition of the assault detachment of the army and its organization and methods in use may well serve as models for the assault detachments of the army corps whose effectives will remain under the control and jurisdiction of the commanders of the army corps.

As soon as their degree of instruction will permit, courses of instruction of the same kinds as those in the assault detachment of the army will be organized in the assault detachments of the army corps.

3. The officers, noncommissioned officers, and men who have taken these courses will form a group of assault in the infantry battalions, the strength of which will, as soon as possible, be brought up to that of a half platoon. If circumstances permit, and the personnel under instruction is sufficient, it will be possible to make more rapid progress carrying on instruction also within the regiments and battalions.

In assembling the groups of assault in the interior of the brigade, a company of assault may be formed provisionally for special missions; in the same way, a battalion of assault may be organized for the army corps. Except when a special mission is assigned, the groups of assault must remain with their battalions so as not to permanently deprive them of this selected and trained personnel. Special training of the assault groups must be constantly continued within the battalions.

The returns of the officers to be assigned individually from the assault detachments to the Rohr battalion of assault[1] must be sent on the first day of each month to the general staff of the army (general of engineers).

4. In all these assault units, instruction must be pushed to its limit. The greatest possible skill in the utilization of terrain and in crossing obstacles, as well as complete mastery of all

[1] Instruction battalion, organized near Longuyon.

means of combat (German and foreign arms, machine guns, grenades, bomb throwers, light trench mortars, etc.), are indispensable factors of success. The cleaning up of the enemy trenches and their immediate utilization for combat are a particularly important part of the instruction. In all training effort must be made to develop in each man the quality of firm decision and a taste for attack. Cooperation with the sector garrisons, the trench mortar batteries, the field and the heavy artillery must be studied in all the training, which will be executed according to a definite plan.

The men must be taught to feel that assignment to the assault troops is a high distinction. The man thus assigned may be aided in feeling this by the fact that his difficult duty excuses him from the normal fatigue duties of the trenches and secures him, in addition, good quarters and good food. It is also recommended that he be favored in the distribution of rewards. The man who has not proved his personal valor and zeal should at once be relieved from duty in the assault units, without any personal consideration whatever.

5. As soon as the assault units have been sufficiently trained they must be given an opportunity to show their value by intrusting them with the execution of an operation which has been minutely rehearsed. As a general rule, the sector garrisons should take part in them. The directors of the operation decide whether the control thereof is to be intrusted to the commander of the assault troops or to the commander of the sector. For such an operation not only is good instruction required in the assault units but also the taste for attack and the feeling of superiority over the enemy must be developed in the sector garrisons. The purpose is to cause permanent damage to the enemy and to find out conditions in his front lines (prisoners). Avoid any great sacrifice of human life and any great expenditure of artillery ammunition.

6. All assault units are temporary formations. Their personnel is considered as on *detached* service.

7. The commanders of army corps will report to the army commander the time and place where assault detachments will be formed; they will state their strength; who is designated to command and when their first course of training will be over. The contemplated inspections will be announced two days in advance.

THE ARMY COMMANDER,
VON SCHUBERT.

Issued down to—Company commanders.
Squadron leaders.
Battery commanders.

EXPERIENCES OF A DIVISION IN RECENT FIGHTING.

ISSUED BY THE GENERAL STAFF, MAY, 1917.

The following extracts from the experiences of a division are published for information:

1. After the first advance the enemy was particularly quiet. Men were able to show themselves on the western slopes of the ridge without being fired at from the neighboring village. It was also possible to walk up to the tactical point at the tower, which had been previously strongly held by the enemy as an observation post.

The commander of the battalion concerned, on hearing of this, at once went up with a view to advancing his line. On his way up to the tower he caught sight of the enemy approaching it in threes and fours by short rushes. Without hesitation he ordered the nearest platoon to charge the tower and establish themselves east of it. The platoon dashed at the tower and arrived there almost simultaneously with the enemy. The platoon established itself east of the tower, killing about 20 of the enemy and taking three prisoners.

That night three unsuccessful bombing attacks were made on the tower. During the battalion relief the next night the enemy opened a heavy bombardment on the tower and its immediate vicinity, following it up with an attack by two companies of infantry. This attack succeeded, chiefly owing to the relief being in progress. A local counterattack delivered by the incoming battalion failed owing to the darkness, pouring rain, and lack of knowledge of the ground.

It was then decided that nothing could be done till daylight. All guns were ordered to be carefully ranged on the tactical point as soon as it was light enough to see. The artillery reported all ready at 11 a. m. The attack was ordered for 12 noon. The batteries opened fire on the enemy at 12 noon on a front of about 200 yards, and two companies of infantry retook all the lost ground without a single casualty.

LESSONS.

(*a*) Boldness of action makes for success.

(*b*) The presence of an officer on the spot who can grasp a situation quickly is invaluable. Much lies in the hands of battalion commanders in this matter.

(*c*) If after a successful attack by the enemy an immediate counterattack is unsuccessful, it is essential that the artillery shall have sufficient time to register the target carefully before further counterattacks are launched.

2. Later a general advance took place. The attack proceeded satisfactorily, as far as the division was concerned, and the objective was reached.

During this period four batteries had been sent forward to be ready to assist in the second phase.

For various reasons, however, by 11 a. m. all the troops were back in the original line.

It happened that in the arrangements for the advance the supporting brigade was to take over the defense of the line. It was, therefore, close up and all the officers and men knew the ground.

Five and a half hours' notice was given for a fresh attack and proved sufficient. The artillery barrage needed some slight adjustment, owing to the absence of the four batteries which had been sent forward.

The barrage started punctually at 6 p. m., and the infantry commenced to move forward.

All went well for the first 300 yards, when an enemy machine gun in a railway cutting opened fire and caused a check; immediately some rifle bombers fired rifle bombs into the cutting and the machine gun ceased fire. This enabled the troops to go forward again, but the barrage had meantime moved away from them, and machine gun and rifle fire was immediately opened on them from a trench some distance ahead. The whole line commenced advancing by section rushes supported by the fire of alternate sections. In this way the advance continued until the left of the line had gained the flank of the enemy, when the fire of a well-placed Lewis gun caused the enemy to surrender.

The remainder of the advance to the objective was carried out in a similar manner by short rushes supported by rifle fire. By the time the troops were established in the objective they had about 50 rounds per man left out of the 170 with which they started.

The battalion commander accompanied his rear company and was in conversation with some of his company commanders during the whole attack. He and the company commanders were able to employ fire power as the situation demanded and keep a grip of the fight.

LESSONS.

(*a*) Supporting troops should be so placed and have such knowledge of the ground that they can be employed at short notice.

(*b*) All ranks must be taught to use their rifles readily and to employ fire to cover movement. The artillery barrage is to be regarded as a useful adjunct and not a necessity.

(*c*) In open fighting battalion commanders should go forward in rear of their battalions so as to be able to take charge in the later stages.

Issued down to—Battalion commanders.
Battery commanders.
Regimental commanders.

INSTRUCTIONS FOR BATTLE.

ISSUED BY THE GENERAL STAFF, MAY, 1917.

Not to be Taken into the Trenches.

1. The Extracts and Summaries, compiled from captured documents, which have recently been issued from general headquarters, as well as other extracts published from time to time in Intelligence Summaries, are of value as showing the principles and methods on which the enemy's defense is based, and which we have to meet and overcome. Commanders of all grades should study these extracts thoroughly, and always with the object of considering, first, how to defeat the enemy's methods when we are attacking him, and, secondly, what we can learn from him as regards the strengthening of our own defenses, so as to enable garrisons to be reduced, thus not only saving casualties, but making it possible to mass larger numbers for an offensive.

2. The field marshal, commanding in chief, desires to call special attention to the following principles which underlie all the enemy's instructions:

(i) The constant insistence on the supreme importance of a spirit of determination to endure and to conquer at all costs.

(ii) Although this spirit of determination is the main factor in success, no material precaution which skill and foresight can provide is to be neglected.

(iii) The defeat and destruction of the hostile infantry is the aim to be held constantly in view. All means available and all methods employed must be directed toward this end.

3. These three fundamental principles do not differ from those on which we also rely. It is on applying them more thoroughly than the enemy that we must primarily depend for success.

4. Another point of great importance is the advantage of surprise. In some instances the enemy ascribes his failure to this

cause. For example, the following, relating to the Vimy Ridge attack, appears in one of the captured documents:

"Although the intended attack was well known beforehand, the reply of our artillery was very feeble during the first days of the artillery struggle, and its fire was not intensified until too late, so that at the decisive moment our infantry were left without the protection of their artillery. It appears that an artillery preparation of several days' duration on the part of the enemy was counted on in certain places, and that, in consequence, the fire of our artillery was reserved, with a view to insuring a sufficient supply of ammunition during the decisive days."

5. In consequence of this and other similar experiences the enemy prescribes very active counterbattery work in future, but always with the same ultimate aim—the defeat of our infantry. The different ways in which his artillery is to assist in this ultimate aim are clearly explained in the captured instructions, and we must be prepared for the possibility of more active hostile counterbattery work, more artillery fire on our assembly trenches, and a heavier fire on our advancing infantry in future attacks.

6. This possibility, however, is nothing new. We know that the enemy has done his utmost in all these respects already, and no extraordinary improvement is likely. In guns, ammunition supply, and observation from the air we have a very decided advantage, and the skill of our artillery and our aircraft in combination has been proved more than equal to anything that the enemy can do.

7. We can increase or decrease the duration of our bombardment as we please, and vary its nature, always subject to the essential need that wire shall be sufficiently destroyed. We can vary the time and often the place of our assaults, and by these and the various other means of deceiving the enemy which have been tried already with good effect—provided secrecy as to our plans and intentions is maintained—we can always keep him in doubt as to when—and sometimes as to where—the assault will start, and so gain at least some measure of surprise.

8. If the enemy enters on an artillery duel our undoubted superiority in artillery and munition supply will enable us to exhaust his ammunition and destroy many of his guns; while such guns as he may still have in action when our infantry assaults are no more likely in the future, than they have been in the past, to check our advance across "No Man's Land."

Once our troops have reached his trenches his artillery fire on our leading waves is masked for a time, and we know that a considerable proportion of his infantry then fail in that spirit of determination to conquer, on which the final decision must always depend. The number so failing will certainly not decrease as the war goes on.

9. We have therefore nothing new to expect in these respects, and the methods we have already employed will still prove effective, so long as they are worked out with the utmost care and applied with initiative, skill, and determination.

10. The system of defense on which the enemy relies *after* our assault has been launched is also explained clearly in the captured instructions. It does not differ in principle from what we have experienced and have overcome during the last few weeks and in the battles of the Somme offensive. To speak broadly, the enemy depends on several systems of trenches, each of several lines, with a considerable distance between the systems; this intervening space is defended by strong points and fortified localities flanking each other, giving a cross fire to the front, and plentifully supplied with machine guns. The trench lines have strong points at intervals, giving mutual flanking fire, and the garrisons are meant to hold out to the death to beat off attack, or, failing that, to facilitate recapture if the position or any part of it is lost. In this system of defenses the enemy's troops are disposed in depth; the object of the whole arrangement being first to wear down and then to destroy the attacking infantry.

11. The Germans lay down that fighting is to be *for*, but not necessarily *in* the first line; but it is clear that this does not mean that the garrison of the first line is not to defend it to the last. On the contrary, it is laid down that only army and corps commanders, and "in most urgent cases" divisional commanders, may authorize the abandonment of any position, although under certain conditions a limited degree of movement is permitted—e. g., troops in shell-hole positions may move in order to reduce losses from hostile artillery fire, but the movement should be local and forward or to a flank.

12. It is clear, therefore, that in the future, as in the past, the garrisons of the enemy's first lines will attempt to fight *in* them, and when we have captured them the enemy's troops disposed in rear will fight *for* them by utilizing any marked pause in our advance to counterattack without delay. When

our advance pushes on into the spaces between the lines or systems of defense, the fortified localities and machine guns in those spaces are depended on to cause us delay and loss and to open up further opportunities for counterattack. In short, the enemy's system is well designed to fulfill the principles on which it is based, viz, to wear out and then destroy the attacking infantry; and with this object in view the enemy's infantry is disposed so that it can be brought into action in successive bodies, those in front preparing the way for the blows to be launched later by those behind.

13. The principles of the tactics we have employed heretofore against this system of defense have been proved sound, although some improvement in details and in execution will always be possible.

14. Speaking generally, we have only been partially successful up to date in pressing home the great successes invariably gained in our first advance, with sufficient rapidity to derive full advantage from the demoralization of the defeated hostile troops.

The exhaustion of the attacking troops, combined with the great depth in which the enemy's defenses are organized and his troops disposed, render the immediate exploitation of success very difficult.

But the strength of the defense lies in the spirit of the troops; and by hard fighting we are steadily progressing toward the time when the morale of the men opposing us will be broken. Then no system of defense, however sound, will suffice to check our advance. Meanwhile, any improvements which can be made in our methods and in the execution of our attacks will hasten the enemy's downfall.

15. Our chief problem, then, is how to push each advance farther than we have been able to do in the past, while retaining the power to beat off counterattacks with equal or greater certainty than before, with less loss to ourselves and with greater loss to the enemy. The thorough knowledge of the enemy's principles and methods, gained by experience and by a study of the documents captured, furnish the data necessary for the solution of these problems, provided we remember that no solution can be satisfactory which fails to take into full account the physical and moral powers of our own men or makes greater demands on them than they can meet.

16. From our intelligence service we know before a battle the strength and approximate fighting value of the troops immediately opposed to us. We have accurate maps of the enemy's defenses; we know from his instructions that normally his troops in these defenses will be disposed in depth, in three bodies of approximately equal strength. We can calculate, therefore, with considerable accuracy the strength of the forces to be overcome by each of our successive waves of assault, and adjust the numbers we allot to each wave accordingly.

The passage of our rear waves of assault through the enemy's barrage presents difficulties, but various ways of overcoming it have been tried with success, and the enemy will always experience at least equal difficulty in passing his counter-attacking troops through our barrage, so that he certainly has no advantage over us in bringing troops from the rear into action.

17. In short, the principle of successive employment of troops, in order to wear down the enemy and then throw fresh reserves in to destroy him, applies to the attack as well as to the defense; and as the attack will probably always be considerably superior in numbers and in weight of artillery fire the advantage lies with it, provided the strength of each assaulting wave is carefully adjusted to its task and no more men are employed in each than are really required; and also provided the rear waves are pushed on in succession as and when opportunity offers or occasion demands.

18. The enemy's system of local counterattack, as applied by him, must be regarded as offering us valuable opportunities of inflicting loss and demoralization. We know by experience that, in accordance with these captured instructions, local counterattacks are launched at once on the initiative of local commanders. We have seen that as a result they are almost invariably launched piecemeal, seldom in great strength, and often with little or no artillery preparation or support, and they have almost invariably failed, with heavy loss to the enemy, as they are bound to fail against staunch infantry (even without artillery support) who have confidence in their weapons and know how to use them.

19. Each counterattack beaten off means heavy moral and material loss to the enemy, and, commencing with a considerable superiority of numbers, a few hours of this style of fighting must leave us in possession of the last reserves on the battle

field, provided we have not used up our superiority by making our leading waves unnecessarily strong. The problem to be solved is how to bring these reserves into action, under control, at the right time and place, and, if possible, well supported by artillery.

We have but a few hours at our disposal, since the enemy only requires time to bring up fresh troops from elsewhere; and it will seldom be advisable to expose our troops, tired, in some disorder after their advance, without prepared defenses, and without efficient artillery support, to the assaults of any large masses of fresh troops. What profits us most is that these fresh hostile troops should be hurried into attacks, which we have made all preparation to meet whilst they are moving up.

But if our advance has come to a standstill, the enemy will probably not throw in these troops as they arrive, but will take time to secure new defensive positions in our front, and to prepare for methodical counterattack. His dispositions to gain the necessary time for this, as we have seen in all recent battles, consist of strong points held by his staunchest men, and numerous machine guns very difficult to locate. This is the style of defense we have to find means to overcome, with as little delay as possible, on the first day of every battle, after our main forces have reached their farthest objective and defeated practically all the formed bodies of trooops immediately oppposed to them.

20. A study of these conditions makes it clear that, in broad outline, the general and normal method of procedure should be as follows in a battle on a great scale:

(i) Close study of the disposition of the enemy's troops up to the last moment, to determine what hostile forces we have to deal with during the first day, what forces are likely to arrive subsequently and how soon, and what their probable line of advance to the battle field will be.

(ii) Determination of the successive objectives, and of the final objective to be captured on the first day. The defensibility of each such objective to be taken into careful consideration, including facilities for artillery support (although our infantry must be trained not to regard that as indispensable to the defeat of a counterattack).

An enemy's trench line is not necessarily a good position to halt on, even temporarily, though mopping-up parties to deal

with it are indispensable and must be provided in sufficient strength and made to understand how much depends on them. The best objectives to choose will almost always be those best suited to cover the advance of our artillery to more forward positions, so that infantry and artillery continue to work for each other, from position to position.

(iii) Very close study of the ground between the enemy's successive lines of defense, and of the ground beyond our farthest main objective, so that probable strong points and machine-gun positions may be located beforehand and artillery fire concentrated on them in due course.

(iv) Careful adjustment of the strength and number of successive waves of assault to the tasks allotted to them. Each stage of the advance to reach a line to be then held against counterattacks, and garrisons for this purposes to be definitely allotted. The final stage (for the day) of the main advance to be on a line chosen for its defensive capacity, especially as regards giving cover to good artillery positions to which our guns can advance.

(v) Some troops to be held in hand from the outset especially to exploit success beyond the farthest main objective. The theory of their employment being that they will come into action after the enemy's main forward bodies have already been defeated, when the opposition met with will be from small garrisons in strong points and scattered machine guns. Their task will be to overcome these, to capture guns and prisoners, to seize and occupy strong points themselves well in advance of our farthest main objective, and to reconnoiter as far as may be possible beyond them, in order to get touch with the advance of hostile fresh troops coming up from elsewhere. These covering troops should act against the hostile reinforcements coming up on much the same principles as the enemy's strong points act against us—delaying the advance and causing as much loss and confusion as possible. If they succeed in seizing and holding a good general line of defense it will generally be advisable to reinforce them and fight on that line, if the general situation admits of this. Otherwise they must fall back if attacked, but not otherwise—drawing the enemy after them—to the line we have chosen for defense while preparing for our next advance.

Small bodies of cavalry (corps mounted troops) working in combination with infantry, tanks, and field guns will be best for this duty. They can be got forward quickly, and it is un-

likely during the first day of the battle that masses of cavalry can be got forward sufficiently rapidly or would find sufficient room for their action. Their opportunity will come later when, by a rapid succession of advances, conducted on the above principles, open country is reached beyond the enemy's fully prepared systems of defense.

(vi) To permit of the free action of these light troops thrown beyond our main farthest objective, artillery barrages must be adjusted to the situation.

This main farthest objective must be chosen with due regard to the possibility of efficient artillery support against strong and methodical attacks by fresh reserves in considerable numbers. But such attacks can not come (usually) for some hours, and against such attacks as the enemy is likely to make on the first day of battle, after our farthest objective has been reached, our infantry should be able to hold their own, and must be prepared to do so, assisted by such artillery as can be pushed well forward, and covered by the light troops thrown out in front. Unless this can be done the system proposed can not be effectively applied.

21. In conclusion, two main dangers to the complete success of an advance and to the retention of ground require special notice.

One of these is failure to "mop up" immediately and thoroughly behind our advancing lines, with the result of the advance being checked and perhaps forced to fall back by fire from the rear. The other is the danger of allowing the enemy to hold out in "pockets," from which he assists subsequent counter-attacks and frequently delays and disorganizes our subsequent advance.

Although the leading waves of an assault should not halt owing to these pockets, provided there is room to pass between and establish the line beyond, it is important that the enemy thus left behind should be rounded up by reserves furnished from the rear without delay, at any rate unless the advance has swept so far beyond as to render these pockets powerless for harm. In that case surrender can be brought about at our leisure.

Tanks, in cooperation with infantry, are very useful for dealing with such pockets, and it will usually be advisable to hold some ready for the purpose.

UNDERGROUND WORKS.

Prepared by the Germans Before Falling Back in Front of the Third Army.

(Information furnished by the Engineer Corps.)

I.

IN TOWNS.

Investigations in the towns of Noyon and Roye, with the object of discovering underground mines, show that it is especially in the neighborhood of important crossroads that the Germans have constructed their works. Most of them exploded, but a number of them failed to go off. A certain number of timber-cased branch galleries were found, the work on which was interrupted, either because of the overflow of water in the ditches or because of deliberate abandonment, due to a change of program, or because of lack of time, the withdrawal having been sudden.

IN ROYE.

(*a*) On the ground floor of a house situated at the corner of a crossroad it was found by raising the floor and digging that the Germans had dug about 5 meters below ground to strike into a sewer (masonry). In a certain part of the sewer, where the sound made by stamping with the foot indicated a hollow below, a new well—not deep—was discovered from which two galleries, with mine casings of 1.80 meters, led off. At the bottom were found two mine chambers, each one having a charge of 75 kilograms. The charges consisted of prismatic packages of "perdite," each charge having in its center a primed fuse. It was to be fired by electricity. The electric wires were cut. According to information furnished by the inhabitants, this work was done since September, 1916.

(*b*) In the same town were found, along a boulevard and at intervals of 40 meters, wooden troughs containing two copper wires joined together with which the current from a high-tension transformer was connected. These troughs were level with the ground.

(*c*) On one of the corners of the Grande Place (central square) of Roye, outside the walls of one of the houses, were found the ends of four wires which pierced these walls. The enemy did not have time to explode the charges, which were to be fired by electricity from without.

IN NOYON.

(*d*) Here all houses, especially their cellars, were thoroughly explored, and in certain large houses (hotels) listening by "geophone" was resorted to, which would have revealed the presence of clockwork in the walls; but nothing of a suspicious character, from this point of view, was found. It was seen that the Germans had excavated the cellars of the cathedral and of the bishop's palace, as well as those of surrounding houses, but these excavations were done with an archæological object in view—that of disclosing the foundations of a Galeo-Roman wall—and also for the purpose of discovering the hiding place of precious objects.

In the Rue de Chauny several open shafts were found under the sidewalks, and ending in timber-cased branch galleries with mine cases. Most of these branch galleries were abandoned when they became flooded. In one place, where two branch galleries ended under a crossroads, two charges, one of 100 kilograms and the other 50 kilograms, were taken out. But, with this exception, neither wire conductors nor explosives were found anywhere.

Boulevard Mouy also had shafts and abandoned branch galleries. In the Place de la Republique the Germans blew up some surface sewers with charges of "mine" shells of 240, inclosed in wooden cases.

II.

ROADS.

Roads were destroyed:

1. Where crossed by trenches. (Excavating the entire width of the road. Trenches 5 to 8 meters broad).

2. At crossroads (very large craters).

3. Crossing streams—the entire width of the road, running upstream and causing a slight overflow.

In towns, as at the crossroads, the Germans formed craters by means of two charges, placed either at the ends of two branch

galleries leading from a gallery or shaft, or at the ends of two bores started from both banks of a road.

The following was found at the crossroads Guivzy-Guiscard-Ugny: A double mine at each entrance of the crossroad. Six mines, only two of which were exploded, placed two together at the center of the road by means of bores. Ignited simultaneously in series of two mines to each group. Charges inclosed in zinc envelopes eight-tenths millimeter thick and soldered. Steel cover with a cap for the charge and priming, and a small steel cylinder to touch off the mine.

Fired by electricity. The explosive was a dark brown, muddy consistency and gave a strong odor of nitrobenzine. It was wrapped in parchment paper. There were two mines of 33 kg. at a depth of 2 meters. Diameter of crater, 5 m.; that is, the width of the road.

III.

CANALS.

It was found that the enemy was usually content to blow up the locks of a canal by charges placed near the hinges, in the abutments, and in the center pier, so as to make two breaks in the canal. Serious injury also resulted to the mason work. This was especially noted at Appilly. Aside from destroying the locks, the Germans made breaks in the towpaths, which caused the water to overflow into the low-lying portions of the valley. One canal was transformed into a river by direct connection between it and the Oise at Channy.

IV.

INUNDATIONS.

A vast system of inundations was carried out in the region of Noyon. It included:

1. Two dikes, with joint piles, preventing the rivers from following their courses.
2. Stopping culverts with cement.
3. Destruction of bridges where crossed by roads and railroads downstream from the town.
4. Upstream, two successive barriers of piers, forming two jetties at road crossings, were constructed.
5. In the towns the obstruction of all sewers and drains with paving and other material was carried out.

NOTES ON RECENT OPERATIONS.

On the Fronts of the First, Third, Fourth, and Fifth Armies.

The following further lessons drawn from the experience gained from recent operations in trench, open, and village fighting, deserve careful study.

It is worthy of note that a study of all actions substantiates the soundness of prewar methods.

ARTILLERY.—(*a*) It has been proved that, with deep objectives and a tendency on the part of the enemy to employ his batteries at long ranges, strong and continued support of the attacking infantry can best be insured by having the greater part of the artillery, both field and heavy, placed well forward so that the utmost value can be obtained from its range. The importance of the principles laid down in Artillery Notes No. 4, Section IV (3) has been emphasized again and again.

(*b*) It is essential to arrange for cooperation between corps artilleries, so that every opportunity for enfilade fire, both in wire cutting, trench destruction, and in counter-battery work, may be fully exploited.

Barrages and wire cutting should overlap at the junction of corps for about 100 yards.

(*c*) Harassing fire by day on unseen communications has proved to be of great value. (Artillery Notes No. 4, Section V (2).)

(*d*) The importance of good counter-battery work can not be overrated. Early location of hostile batteries, destruction during the period of preparation, and neutralization at the moment of assault, are the main essentials.

The value of gas shells for neutralization is undoubted, and no opportunity for their employment against an enemy who is trying to move his guns must be lost.

(*e*) The importance of the most careful calibration can not be overstated.

(*f*) The necessity of care of buffers needs to be constantly emphasized.

(*g*) Knowledge on the part of junior officers as to how, what, and when to report, is much needed. The necessity for early

and accurate information from F.O.O.'s can not be too strongly emphasized.

(*h*) Whenever an advance is contemplated, early reconnaissance of possible routes off the roads should be made. Careful plans must be made for crossing our own and the enemy's trench systems; special parties must be detailed for the work of preparation. The importance and difficulty of a rapid advance are not yet fully realized.

(*i*) In any battle where a deep advance is looked for, there should be one or two brigades R.F.A. per division, ready to move forward at the earliest possible moment.

(*j*) It has been found to be advantageous in the first stages of an advance to make use of single guns, or sections, with limbers and teams up with them.

Difficulties of supply, chiefly in the matter of ammunition and water, will usually prevent the similar use of larger units.

(*k*) Battery commanders (R.F.A. in particular), must pay more attention to the use and value of direct observation, and of control of their batteries by voice or through a short telephone line. There is a tendency to place batteries in fully concealed positions and then to wait while the F.O.O. gets out a long telephone line.

(*l*) As the enemy is driven back from his prepared trench systems, where the general lines of defense have become familiar to our artillery and are accurately marked on our trench maps. the importance of careful study of air photos increases. The enemy dig rapidly and well, and the defenses of positions which we are going to attack grow quickly day by day. Unless the most recent air photographs are constantly and carefully studied before artillery tasks are allotted, there is the danger that a vital portion of the enemy's defenses may be neglected by the artillery, with serious consequences to the infantry assault.

Royal Engineers.—(*a*) One or more sections of Royal Engineers should move with the advanced guard to remove obstacles and to effect such minor repairs as can be carried out with the stores and tools carried in section tool carts. In addition, mounted reconnaissance parties of Royal Engineer officers and N.C.O.'s should be pushed well forward to report on the nature and extent of damage of a more serious nature, to deal with which necessitates special arrangements being made.

(*b*) In country where the wells were normally of great depth the employment of helical chain or canvas band pumps has been found of great value.

INFANTRY—*Patrols.*—The enemy frequently employs strong patrols. These attack or attempt to cut off our patrols, if weak, and retire before strong ones. The use of strong patrols (10 to 20 men) is therefore indicated. Such patrols should be plentifully provided with S.A.A., and bombers, rifle bombers, and a Lewis gun should be included in these numbers.

A patrol which has succeeded in penetrating the enemy's line should establish a post on the enemy's line of retreat.

Advanced posts gained and established by day are often heavily shelled. It has therefore been found advisable generally to reconnoiter by day and gain ground by night.

The normal formation and movements of patrols should be constantly practiced. Front, flanks, and rear must all be guarded, and movements must be made by BOUNDS. All ranks must be taught to realize that information must be got back to the proper quarter, no matter how heavily the patrol may become engaged. Relay posts should be formed if necessary.

A valuable lesson is brought home by the difference in conduct, and consequently in casualties, of two patrols, each of 12 men, when held up by machine-gun fire:

In one case the men lay down when fired upon, and the Lewis gun was used to cover the operations of the remainder of the party. The movement of the Lewis-gun detachment was then effected under cover of rifle fire. Casualties, 2.

In the other case the patrol made no attempt to open fire and ran for shelter to a trench. Casualties, 10.

Outposts.—For outposts low-trip wire is preferable to high wire.

It is often advisable after a post has been dug and wired to place the garrison by day in a fold of the ground some little way off.

Infantry weapons.—The value of the use of fire to cover movement from the various weapons at the disposal of infantry has received still further emphasis. As regards the individual weapons:

The rifle.—Full use is not being made at present, in many cases, of the rifle. It is necessary constantly to impress upon troops that the rifle is their principal weapon and must be regarded and used as such.

Rifle bombs.—These have been found an efficient auxiliary in dislodging the enemy from behind cover and in street fight-

ing. Their moral effect is great. It is recommended that half the bombs carried in the mobile reserve of units should be rifle bombs.

The Lewis gun has been found invaluable as part of the platoon. It may be used to engage the enemy while his flank is being turned or if he opens fire unexpectedly. In some cases it has proved a useful reserve of fire power for the platoon commander. With patrols its effect is hard to overestimate.

Machine guns.—Every opportunity of overhead, enfilade, and cross fire by machine guns must be seized. The effect of such fire is so great that it outweighs the risk of causing casualties to our own men.

Subsections should not be allotted to lower formations than a battalion. When so allotted the officer in command should keep in close touch with the battalion commander to insure cooperation and to look after the arrangements for the rations, supply, and comfort of his own men.

Machine guns should move forward by BOUNDS, some being ready at all times to assist the Infantry by their fire.

The 3-inch Stokes mortar.—This has been found most useful against strong points or against enemy in buildings. Arrangements should be made for ammunition to be carried either by pack or by a special allotment of transport. In some cases a subsection of machine guns and two Stokes trench mortars were allotted to advanced guard battalions. It was found satisfactory in such cases to detail a limbered G.S. wagon from the machine-gun company to carry Stokes trench mortar ammunition.

House-to-house fighting.—In house-to-house fighting, where cellars of houses are connected underground, parties must be tolled off—

(*a*) For underground work;
(*b*) To search houses;
(*c*) To move along outside the houses, both front and back;
(*d*) To deal with the outhouses.

When saps run out from cellars under a road it is necessary to establish blocks at the junction.

Where resistance is met with in houses cellars are usually barricaded.

Lewis or machine guns should be posted to cover the streets and fire on any enemy emerging from houses or cellars.

In street fighting the clearance of each house may constitute a BOUND.

Movement to forming-up place.—Where no natural features or trenches exist on the ground selected as the forming-up place for an attack the line should be marked out by tapes.

The movement of troops up to the taped line must vary according to circumstances. In some cases movement in single file, in others in artillery formation, has been found to be the best.

Negotiating hostile barrage.—The formation to be adopted for passing through a hostile barrage must be suited to the conditions on the ground. On one occasion two battalions passed through in file with few casualties, on another a battalion passed through in artillery formation with equally few casualties.

Moppers up.—It is more difficult to "mop up" in a village or wood than in an attack on a position in the open, but it is equally important.

Village and wood fighting.—To delay in a wood or village is dangerous. Provided sufficient "moppers up" are detailed, the assaulting troops should pass through and get well clear of the wood or village as quickly as possible.

Unless the position selected for consolidation is well beyond the far edge of the wood or village, adequate artillery support can not be given.

Use of reserves.—It is cheaper to employ troops in sufficient depth in an initial operation than to have to repeat it in consequence of failure. When the reserve units have passed through the original assaulting units steps must at once be taken to reorganize the latter as quickly as possible and form them into reserves.

INTERCOMMUNICATION.—The use of visual and wireless signaling, including the power buzzer, has been much neglected, but where full use has been made of these means important results have been obtained.

When signalers have been detailed beforehand to work with advanced troops, visual signaling, both with flag and lamp, has been successfully employed.

When new headquarters have been established, runners should not be sent always to the same destination. It is essential that they should eventually obtain a general knowledge of the geography of the occupied area and not only of one particular run.

It is part of the duty of signaling officers to pass on information; this has been frequently neglected.

Very incomplete reports have frequently been received. A card on the lines of Appendix I., S.S. 148, is being printed and will be issued shortly. It is necessary continually to insist upon the importance of early and accurate information.

The various means of communication with aircraft require to be practiced with greater frequency than at present.

Emphasis must again be laid on the necessity of carrying out the instructions for the use of telephones.

It must not be imagined that because we have driven the enemy from his front trench systems he can no longer make use of listening sets. The contrary is the case. It is easier for him to tap telephone conversations than it was, since many of his old buried cables run from the area now occupied by us into his line.

Aeroplane Contact Patrols.—These were found most useful, working with both the infantry and mounted troops. They assisted materially in reconnaissance, and were able to give valuable information as to the enemy's strength and position. Messages with this information were dropped at battalion, brigade, and divisional headquarters.

Care must be taken to insure that infantry and mounted troops carry flares to assist these contact patrols and understand how and when they should be lighted.

In the pursuit, if the weather is favorable, these patrols should have many opportunities of harassing the enemy with bombs and machine-gun fire.

Transport.—Pack transport is often necessary, but it must be remembered that this method is wasteful and entails a greater strain on animals than on wheeled transport for moving the same quantity of material.

Traffic controls should be got forward on the battle field as soon as possible, but officers commanding transport are responsible for regulating the march of their own transport.

An order of precedence for horsed and motor transport should be laid down according to the state of the roads, i. e., if roads are bad, horse transport should be given precedence; if roads are good, motor transport, so as to get it off the roads sooner and leave them free for horse transport.

When ground has been gained, a forward turning point for all transport, including lorries, must be established as soon as possible.

Supply.—The following allotment of pack transport was found to work satisfactorily in one division.

Pack animals were used almost entirely to feed the troops in the front line, both before and after an attack.

After one attack rations and water were taken up by pack animals to within 200 yards of the front line.

Practically all the pack animals were mules; very few horses were used.

The number of pack animals per battalion was made up to 30.

For one attack these animals were loaded as follows, with a view to establishing a forward dump as soon as the objective was gained:

	Animals.
100,000 rounds S.A.A	50
200 petrol tins	25
1,440 grenades, No. 5	20
4 boxes Very lights 1''	2
4 boxes red flares	2
200 rifle grenades	5
5,000 sandbags	10
Spare	6
	120

These were divided into four sections, each section under a battalion transport officer, the whole being under the brigade transport officer.

Each section was further subdivided into four subsections under an N.C.O.

The same organization was employed for the carrying of rations and worked well.

The saving of carrying parties by using pack animals is very great and increases the fighting efficiency of the units considerably.

Each brigade had the same number of animals, which worked only for their own brigade. In this way both men and animals got a rest when its own brigade was out of the line.

These animals went up at dusk. The column, which is given in detail above, was held ready to move up during the morning if the attack was successful and circumstances demanded their doing so.

About 40 men were required for loading mules, but in consequence of this use of pack transport carrying parties were few and small.

REPORTED TACTICS AND METHODS OF THE ENEMY.

Retirements have generally been carried out by the enemy between 3 a. m. and 5 a. m. Previous indications have been given by fires and explosions. An unusual number of Very lights have often shown when withdrawal was being effected.

Artillery fire has usually increased before withdrawal commenced, presumably to use up the ammunition with the gun.

Field guns and howitzers have often been posted in small posts in advance of the main positions.

Enemy batteries appear to have little cover for their guns, but good cover for their men and ammunition.

Trees are again being largely resorted to for O. P.'s.

Thick belts of wire are often erected all around a battery's position.

Machine guns are handled very boldly. The detachments have appeared suddenly from cover, mounted the gun, fired, and then returned to cover.

In open fighting machine guns have often been found in sunken roads and behind fallen trees. In the defense of villages they have normally been placed well clear of the buildings.

Instances have occurred of the fire of enemy machine guns being withheld till our troops have passed them, but in the majority of cases machine guns have opened fire as soon as they have obtained a target.

MISCELLANEOUS.

(i) Old enemy headquarters should be avoided. They are generally heavily shelled.

Officers should not crowd together in the same house or cellar.

(ii) A plentiful supply of name boards for use in occupied enemy trenches is most necessary and should be prepared in advance.

(iii) Arrangements should be made to send hot food up to troops in the front line, if possible, once a day.

(iv) In open fighting a continuous line of defense is not only unnecessary but impossible. It is essential therefore to study and to practice the method of holding mutually supporting tactical points.

(v) Each body of troops is responsible for its own protection. Flanks and rear, as well as front, must be watched, however small the unit.

(vi) The usefulness of tanks is that of auxiliaries, not principals. Reliance on assistance from them must not form the foundation of any proposed operation.

(vii) Medical officers should carry labels to show whether wells, etc., that they test are fit for use or not.

(viii) No preparation for an attack is complete which does not include the steps to be taken to meet the enemy's counter-attacks that will almost invariably follow any success on our part.

(ix) Both field glasses and compasses are part of an officer's kit, and are essential for operations.

(x) Mounted officers must make use of their horses, both to save time and their own and other people's legs.

(xi) As soon as one objective has been gained, reconnaissance and preparation for what is likely to be the next objective must commence at once. If this is done, there will generally be ample time for final preparations when orders are received.

(xii) Guides to take troops to the place of deployment should, whenever possible, belong to the unit going up. They should have previously made certain of the road and marked it out with tape or other means. Troops marching, especially at night, should send ahead to prevent checks, etc., and to arrange for the removal, if possible, of any obstacles which are likely to delay them.

SUPPLY OF AMMUNITION IN THE FIELD.

Issued by the General Staff, March, 1917.

1. The old organization for the supply of ammunition in the field by means of brigade ammunition columns and a divisional ammunition column was designed to meet the requirements of a division acting independently, so that the division might be self-supporting. Owing to the necessity for massing far more troops on a given front and the consequent increase in depth of our present organization, the corps has now become the unit for marching and fighting. A corps, consisting of two or more divisions, must accommodate itself on a front little greater than that formerly allotted to a division, and may have to move along one road.

The density of troops on a given front automatically creates an accumulation of ammunition, and, by the system of "pooling," a considerable reduction may be made in the number of rounds per gun carried with the fighting formations.

The new organization has therefore been introduced with the objects—

(*a*) Of pooling the ammunition carried under corps control and thereby reducing the number of rounds per gun to be carried.

(*b*) Of effecting a saving in personnel, horses, and vehicles.

(*c*) Of reducing the road space occupied by a division.

(*d*) The experience of the earlier part of the war showed the necessity for separating brigade ammunition columns from their brigades and concentrating them under one central control.

2. A further change has recently been made in the organization of the divisional artillery to meet the requirements on an offensive front. One brigade of field artillery has been withdrawn from each division, and these brigades have been regrouped to form "army field artillery brigades." The divisional artillery will therefore consist of two field artillery brigades, each brigade having three 6-gun 18-pounder batteries and one 6-gun 4.5-inch howitzer battery.

The army field artillery brigades will consist of three 6-gun 18-pounder batteries and one 6-gun 4.5-inch howitzer battery, or four 6-gun 18-pounder batteries. These brigades will be available to reenforce the artillery on any offensive front as may be required.

3. Organization of the Divisional Ammunition Column.—The brigade ammunition columns, as such, have been abolished for divisional artillery, and the divisional ammunition columns have been reconstructed into two echelons.

"*A*" *echelon.*—Divided into two sections.

It consists of one ammunition wagon for each gun and howitzer in the division and S.A.A. carts, etc., to carry the same quantities of rifle and machine-gun ammunition and grenades as were formerly carried by the brigade columns.

The sections are equally divided, the number of vehicles to each section is the same, and they contain the same percentage of gun, howitzer, and S.A. ammunition.

"*B*" *echelon.*—Has one section.

It consists of some of the G.S. wagons which formerly carried gun and howitzer ammunition in the old divisional ammunition column, and G.S. wagons to carry the same amount of S.A. and machine-gun ammunition and grenades as was formerly carried by the divisional ammunition column.

4. Organization of the Brigade Ammunition Column.—To each brigade of the army field artillery will be allotted a brigade ammunition column. It will consist of one ammunition wagon for each gun and howitzer in the brigade, with a proportion of G.S. wagons for baggage, stores, etc.

5. The new divisional ammunition column is directly under the divisional artillery commander, and forms an integral part of the divisional artillery. It may still be drawn upon as a first reserve for the batteries in men, horses, and material in an emergency.

It will normally march with the division; but, when several divisions are marching on one road, it may be necessary to withdraw the "B" echelons, and concentrate them in rear under corps control. The "A" echelons always accompany their divisions, and will usually march in rear of all the batteries. The divisional ammunition column commander will remain with the "A" echelon.

In action, the divisional ammunition column will usually be concentrated, but, when the wagon lines are a long way from

the guns, wagons from the "A" echelon may be attached to the batteries to assist in taking up ammunition.

If the ammunition park is a long way in rear, it may be necessary to keep back the "B" echelon, and push up the "A" echelon, but this case will be the exception rather than the rule.

The normal position of the divisional ammunition column commander in action will be where he can best control the supply of ammunition.

The normal chain of supply of ammunition will be from the subpark (which has now been transferred from lines of communication to corps control) to the "B" echelon, and thence to any section of the "A" echelon.

6. In the case of the army field artillery brigades, the normal chain of supply of ammunition will be from the subpark direct to the brigade ammunition column.

7. As the new organization has reduced the number of rounds carried in divisional charge, it is essential that the column be looked upon as a pool from which ammunition can be drawn by any unit. It is not intended that certain sections of the "A" echelons should be affiliated to certain artillery brigades, but the organization is elastic, and permits of the detachment of such an amount of ammunition as may be considered necessary for a specific task.

INFORMATION FROM CAPTURED DOCUMENTS.

JULY 3, 1917.

A sergeant major of the two hundred and sixty-first reserve regiment, seventy-ninth reserve division, was captured in our raid on the 1st instant southeast of Souchez. His notebook contained a number of entries of interest, and a translation of some of these is given below. The entries appear to have been made during a course of training which this officer did on his first arrival on the western front from Russia.

A. RAIDS.

1. Accurate knowledge of the enemy's positions through patrols, aeroplane photographs, etc.

2. Destruction of enemy's obstacles; gaps in his wire to be cut on the previous day; machine guns to prevent repair of wire.

3. Agree upon signals.

4. Shoot flares from our own trenches.

5. Divide raiding party into assaulting party, blocking party, mopping-up party, explosives (mobile charges) party, escort for prisoners, and stretcher bearers.

6. Remove all identifications, viz, letters, sketches, identity disks, shoulder straps, etc.

7. Make password known.

8. Caps preferable to steel helmets. White brassards are not practicable because of their visibility.

9. Take sections of tent for booty and wounded.

10. Take flash lamps, luminous watches, tape, wire cutters, "Very" light pistols.

11. Hang revolver round neck, bombs in handiest place; daggers and knobkerries are the best trench weapons.

12. Raid with and without artillery preparation.

13. In the former (with artillery preparation) the aim is to penetrate into the enemy's line. If the area to be raided is large, heavy artillery and trench mortar fire on the objective, changing to a box barrage at the agreed hour.

14. In the latter case the aim is to surprise the enemy. All raids have the object of bringing in prisoners and booty.

METHODS OF WAR ON THE WESTERN FRONT.

B. POSITION.

Three or more lines. Small sectors. Regimental frontage, 1,500 meters.

(*a*) One battalion in front line.

(*b*) A second battalion in reserve line.

(*c*) A third battalion in rest.

Strong organization in depth.—Two companies in firing line; two in second line; platoons in echelon.

Strong points and switches, each with commanders.

Rations must be abundant. Every man self-contained in this respect.

Transmission of orders.—Runners most reliable.

Machine guns.—Machine guns are mostly kept in the second and third lines, also in the fourth line. British even have chained down their machine guns (?).

Trench mortars.—Every company to have trench mortars.

Sentries.—Platoons will place sentries, i. e., stationary sentries. They will be instructed in their duties and with regard to the situation of their position.

Attack and defense.—The British prefer to attack at regimental or divisional boundaries, even company boundaries. They seldom attack strong points.

If the enemy has penetrated our front line a counterattack will be made from the second line. The garrison of the front line will remain in their dugouts till the counterattack is successful.

Counterattack with artillery preparation, i. e., to regain a lost section of trench. Stationary sentries will remain in position in the trench from which the counterattack is launched to give information to messengers, to pass on orders, to guard the trench, and to pass orders to the rear. By day black flags will be placed at each end of the lost section of trench, by night white. "Very" lights will be shot up perpendicularly from these points to show our artillery where to fire.

Means of communication.—Carrier pigeons, runners, telephone, and chain of relay messengers.

Each commander will have his defense position and will be in touch with adjoining sections.

Sentries will observe the enemy closely and will report everything they see.

Reliefs take place at night. Entrenching tools are carried, also methylated spirits for cooking, packs to be left behind, as a rule, only absolute necessities to be taken into the line. Reliefs must take place in silence.

Gas attack.—As soon as the alarm is given shoot up red and green flares. Our artillery fires into the gas cloud and on the hostile trenches. The enemy also uses smoke bombs and shells to imitate a gas attack; no danger of gas poisoning.

Barrage is often placed immediately in front of our trenches. No barrage possible where enemy lines only 20 meters distant.

Artillery fire of various kinds.—Barrage, gunfire, destructive fire, and retaliatory fire.

Tanks.—The British armored cars are not very dangerous but can only be dealt with by artillery.

Extracts from a German Document, Issued by the Sixth Army September 27, 1916, Entitled

SUPPLEMENTARY INSTRUCTIONS AS TO THE CONSTRUCTION OF DEFENSES.

GENERAL PRINCIPLES.

1. Corps must make the greatest efforts to improve the defenses *in depth*, and to provide them with good obstacles and switches at those parts of the front which are especially threatened by a hostile attack. All salients and all mining areas should, as a matter of course, be cut off by retrenchments.

When work on a new line has to be begun, the obstacles should be erected first; the concrete structures and shelters which require a long time for completion should then be proceeded with.

In order to insure that the fire trenches, which may be subsequently dug, shall bear the proper relation to the concrete-built flanking works, the fire trenches should be excavated provisionally to a depth of 1 foot, but to their full width. Preparatory work of this kind will alone enable large working parties to be taken full advantage of, if they become available, and if operations are to be carried out on a large scale.

All localities in the lines of the rearward positions should be organized for defense as strong points.

FRONT-LINE TRENCH.

2. The principal fighting line is the front line; approval of army headquarters must be obtained if, for local reasons, it is only intended to treat it as the outpost position.

TRACE OF TRENCHES.

3. In tracing the lines great care must be taken to secure flanking fire. The flanking defenses form the framework of a position and should be traced by commanders in cooperation with the general staff.

DESIGN OF TRENCHES.

4. Where the widening of existing narrow trenches can not be done throughout, it should at once be executed at the entrances to shelters, so as to form courtyards and insure the possibility of defense, even if the trench is blown in.

WIRE ENTANGLEMENTS.

5. *The trace of the wire entanglements should be entirely independent of that of the fire trenches.* This will prevent their being destroyed by the enemy if he relies on the plan of the fire trenches in aeroplane photographs for their positions.

Entanglements, if destroyed, must be reconstructed at once.— If the entanglement in front of the first trench has been destroyed, its reerection must take precedence of all other work on the position, and every means at our disposal must be employed.

COMMUNICATION TRENCHES.

6. As, in the event of hostile attack, communication and approach trenches are exposed to heavy fire, cross-country tracks must be reconnoitered and clearly marked, so as to be available both by night and by day. They should not be used during quiet times, or the signs of traffic will betray them to aeroplane observation.

Care must also be taken, while an action is in progress, that roads are not used in more than one direction.

DUGOUTS.

7. Concrete shelters are preferable to mined dugouts in all circumstances.

From our experience on the Somme, mined dugouts require from 23 to 26 feet of overhead cover in hard chalk and of from 33 to 36 feet in clay. Such dugouts are impracticable in front line as men can not reach the fire step in time from such depths.

Concrete shelters should be built in future of reinforced concrete, 5 feet thick (2 feet 8 inches hitherto).

In a gas-cloud attack, braziers with low fires have kept the shelters completely free from gas. The shelters should be distributed over all three lines of trenches of a position, as required by the distribution of the formations in depth.

In general, too much can not be done to provide secure shelter from shell fire on reverse slopes for the reserves. If there is not sufficient time to make complete dugouts, numerous recesses in the form of gallery entrances will answer the purpose.

OBSERVATION POSTS.

8. Shell-proof infantry observation posts *must* be constructed in all trenches of the first and second line positions.

MACHINE-GUN EMPLACEMENTS.

9. The ruling factor in the siting of fire positions for machine guns is that they must be echeloned in depth. It is advisable, therefore, to construct machine-gun emplacements not only in the trenches but in the spaces between the lines. Machine guns should only be placed in the first trench when they can bring flanking fire to bear and when the foreground near the enemy can not be swept from a machine-gun position on high ground behind the line.

TRENCH MORTAR EMPLACEMENTS.

10. Trench mortar emplacements may sometimes be constructed in the second trench but are preferably placed between the lines. They should be sited near those points which are particularly menaced by the enemy or where an increase of the artillery barrage fire is necessary.

GENERAL STAFF (INTELLIGENCE),
GENERAL HEADQUARTERS,
May 5, 1917.

Translation of a German document.

EXPERIENCE OF THE GERMAN FIRST ARMY IN THE SOMME BATTLE.

JUNE 24 TO NOVEMBER 26, 1916.

By GEN. VON BELOW.

PART I. TACTICAL.

30 JANUARY, 1917.

A. PRELUDE TO THE BATTLE.

1. The Somme Battle did not come as a surprise to the second army, which, from the 19th July, 1916, onward, was divided into the first and second armies. As early as February, 1916, our aeroplanes reported the construction of numerous new hutments in front of the northern wing of the army on both sides of the Ancre. Shortly afterwards an increase in the number of divisions on the English front north of the Somme took place. As a result of successful raids and patrol work, we learned that these divisions were relieved successively after a few weeks in line. Toward the end of April the number of English divisions north of the Somme had already increased to 12, opposed to only 4 German divisions.

The plan which was formed at that time of meeting the enemy's expected offensive north of the Somme by a counteroffensive could not be carried out owing to lack of sufficient forces. In April one division was placed at the disposal of the army as a reenforcement. This division was put into line north of the River Ancre, where the English line was most strongly held. Thus, on the right wing of the army, each division held an average front of 6 kilometers, while on the rest of the army front the divisional sectors amounted to 7½ to 9 kilometers.

In May two divisions were withdrawn from the front of the second army and replaced by one division which, during its short period of rest, had not yet been able to replace the losses which it had suffered at Verdun. In addition to this a consider-

able number of heavy batteries equipped with modern German guns were replaced by batteries of captured guns.

Up to May it was not considered probable that the French would cooperate in the expected attack.

At the beginning of June the signs of an approaching attack became more evident. Just north of the Somme two French divisions took over the sector previously held by the English. The conclusion at first drawn, that this measure had a defensive object with a view to giving greater depth to the English offensive, mounted further north, was rejected as soon as the specially good Twentieth French Corps, known as a "gladiator corps," was identified by raids north of the Somme. South of the Somme, also, preparations for a hostile attack became more and more apparent, so that during the course of June, the supposed frontage of the enemy's offensive was fairly clearly established as extending from the neighborhood of Gommecourt on the north, to the neighborhood of the Roman Road, about 8 kilometers south of the Somme, on the south.

In June one division and the field artillery of another division were placed at the disposal of army headquarters. Toward the end of June a further reenforcement of 17 light field howitzer batteries was allotted to the army.

2. On the 22d June the enemy's bombardment began to become intense.

From the 24th June onward the intense bombardment was continuous. This bombardment comprised a large proportion of artillery of the heaviest calibers and of heavy, long-range guns.

On the 1st July, about 8 a. m., the great English-French infantry assault took place on a front of 40 kilometers between Gommecourt and the west of Vermandovillers, while the artillery bombardment was continued on a sector which considerably overlapped the zone of attack. The assault penetrated our badly damaged defensive front at a great many points. North of the Ancre, by the evening of the 2d July, counterattacks were successful in recapturing the whole of our line, and inflicted heavy losses in killed and prisoners on the English. South of the Ancre also, as far as Thiepval, inclusive, the English, who had captured our trenches, were driven out of them by the evening of the 3d July. On both sides of the Somme, however, the English and French had driven a deep wedge into our defensive front. On this sector our losses were so considerable that there was no available strength with which to carry out the intended counterattack.

During the following days and weeks we continued to lose further ground at this broad breach in our front. The engagement of the reenforcements, which flowed in to the army from all sides, had to be effected in the most unfavorable circumstances. Owing to the overwhelming superiority of the enemy in aircraft, artillery, ammunition, and men, it was only possible to stop the most dangerous gaps which had been made in the German defensive front. Owing to the force of circumstances, the cohesion of the arriving reenforcements had to be broken up in order to avoid the danger of the enemy breaking through.

Under these difficult conditions the whole organization of the defense had to be constituted anew. It was only after the lapse of long weeks that the defense could be put on equal terms with the enemy's superiority as regards fighting material of every kind.

In spite of this, the enemy has not succeeded in achieving the intended breaking through of our western front. His plans have been shattered by the devoted and untiring courage and loyalty of our army. Every man who has fought on the Somme may be proud that he was there, and that the battle, which is so far the greatest in any war, has, through the failure of the enemy, ended as a German victory.

B. OBJECT AND ARRANGEMENT OF THE LESSONS LEARNED.

3. The numerous lessons learned from the Somme Battle have already been dealt with and published in part 8 of the chief of the general staff's instructions for trench warfare entitled "Principles of Command During a Defensive Battle in Trench Warfare."[1] A thorough acquaintance with these instructions is, therefore, assumed as a preliminary to studying and understanding the following remarks, which have been published by the First Army at the desire of the Crown Prince of Bavaria's group of armies. In this memorandum, the "Principles of Command During a Defensive Battle," will only be referred to in so far as the events on the Somme are concerned; the organization, tactical employment, and cooperation of the different arms will be described in the light of the experience gained during a battle in which the forces involved have been on a scale hitherto unknown.

[1] This is being issued separately.—G. S.

The subject matter has been divided up in such a way that in Part I (Tactical) the different arms are treated under the following subheadings:

(1) The causes of initial failures.
(2) The measures by which a gradual improvement was attained.
(3) Experiences and lessons.

In this way a picture of the development of all details of the fighting during the battle will be obtained, which will perhaps be of use to a commander who may in future find himself engaged in a battle of similar nature.

Part 2 deals with all questions connected with administration and interior economy.

C. HIGHER COMMAND—EXPERIENCES AND LESSONS.

4. Before the beginning of the Somme Battle the headquarters of the Second Army, as then constituted, had grouped the five divisions north of the Somme and the four divisions south of the Somme under the two corps staffs which were available in the area, in order to obtain a uniform system of command throughout the anticipated zone of attack. The battle frontage of the two corps thus constituted amounted to 22 miles north of the river and 20 miles south of the river. The initial attack by the enemy astride the river, and the consequent reentrant created in our line, increased these frontages considerably. The divisions sent up as reenforcements by the supreme army command were only accompanied very gradually by fresh corps staffs, and these staffs were totally unacquainted with the Somme battle front. Their entry into line did indeed reduce the frontages held by formations, but the commanders had to become acquainted with the ground before they could carry out their tasks.

The ever-increasing size of the Second Army prompted the higher command to reorganize the troops engaged on the battle front in the First and Second Armies. This change took effect from the 19th July. The First Army took over approximately the same battle front as had been previously held by the northern corps of the Second Army. This sector was gradually divided up between five groups, each under a corps headquarters, each group commanding two or four divisions.

It was not till the 1st October that the new First Army was given a separate lines-of-communication headquarters. Until then its administration was effected by the lines-of-communication headquarters of the Second Army.

5. The difficulties of command which arose from the constant change of sectors and staffs were very considerable, and were still further increased by the frequent shifting of headquarters, rendered necessary by the loss of ground; this had a most deleterious effect on the smooth running of telephonic communication. A rigid system of command, equal to all demands, could not be thoroughly established until the organization of the army was placed on a clear and permanent basis; unity of command was then attained by retaining more or less permanent corps staffs in sectors.

It is evident that an army which is subject during a battle to constant changes of command is, especially when acting on the defensive, at a very great disadvantage as compared with an attacking enemy whose organization has been thoroughly planned with a view to carrying out his designs. As far as possible, therefore, efforts must be made, whenever a hostile offensive on a large scale is anticipated, to organize the system of command in good time and on so firm a basis that the army and corps headquarters can retain command of their former sectors during the progress of the battle.

6. The lateral boundaries of the battle sectors of armies, corps, and divisions are primarily dictated by the ground, and, above all, by the facilities which they give for the development of artillery fire and for artillery observation.

7. In the heat of the battle the influence of a well-known commander plays a great part. Acquaintance with the personality of his subordinates, an appreciation of their abilities, and a right judgment of their qualities enable the higher commander to make his decisions as regards the employment of his troops at the decisive points of the fight. This is especially the case as regards the divisional fighting units. It is therefore desirable that divisional commanders should change with their divisions.

8. As regards corps headquarters, which, during a battle, command a group of three to four divisions, it is desirable that they retain command of their own original divisions as far as possible. Within a group, however, the advantage of fighting under a commander whom one knows is secondary to the consideration

that the command must be on as permanent a footing as possible. This condition can only be attained by allotting permanent corps staffs to sectors.

9. The demands made on the staffs of armies, corps, and divisions by the work and responsibility entailed in the course of a great battle of long duration are so enormous that the usual number of officers allotted to staffs is not sufficient. To every corps headquarters a permanent chief administrative staff officer was therefore allotted during the battle, principally for duties of supply, and also a permanent general staff officer; each division was allotted a second (permanent) general staff officer. Corps and divisions were also allotted permanent pioneer and communication officers, while, in addition to the above, permanent wing commanders, antiaircraft officers, and wireless officers were allotted to corps headquarters.

The number of orderly officers, also, required to be increased in order to provide the personnel for visiting the trenches (a procedure which demanded much time) and for keeping in personal touch with the subordinate commanders, as well as to convey to the higher commanders a picture of the events of the battle independently of the reports received from the troops.

10. It is of much importance to make new formations acquainted in good time with the battle situation. General staff officers must, therefore, be sent ahead at once to gain touch with every new corps and division arriving.

Besides the above, during the last weeks of the battle, army headquarters sent a copy of all orders dealing with general principles to the staffs of formations which were earmarked for future inclusion in the army, through the medium of their old formations. The higher commanders, as they arrived, were then interviewed personally by the commander in chief or by the army commander; the importance and nature of the Somme Battle was explained to them, and they were also made acquainted with the features of the ground in their future sectors and with the instructions and general principles already issued by the army for the battle. General staff officers, artillery commanders, and pioneer commanders of the relieving corps and divisions worked for several days, prior to the arrival of their own formations, with the staffs of the formations to be relieved; these latter formations, in turn, left part of their staffs behind for several days after the relief.

11. It is of great importance for the execution of the command during a battle that the higher commanders should

obtain a rapid knowledge of the progress of events which are taking place in front. This knowledge often forms the only basis for sending forward and putting in reserves at the right moment. Army headquarters have, with this object, organized in each group sector special army observation posts. A similar organization was formed in all corps and divisions. A special artillery system of telephonic communication connected to the headquarters of the general officer commanding artillery has frequently provided the most valuable rapid pictures of the situation.

12. In their conduct of the battle, army and corps headquarters must, in addition to issuing strict orders as regards defensive work, confine themselves principally to insuring clear and well-defined relations in the grouping of the troops and in the holding in readiness of reserves behind dangerous points. Both the commander in chief and the army commanders will obtain the best foundations for their decisions by keeping constantly in personal touch with the commanders of the troops. Verbal discussions are of considerably more value than telephonic conversations. During the Somme Battle the commander in chief, in company with the army commander, visited almost daily three or four divisional commanders at their headquarters or their battle stations. These interviews, at which the group commanders were usually present, were of great advantage to the unity of control in the battle and to the cooperation of all arms. This procedure was of particular value at moments when the situation was rapidly changing. After such conferences, army orders and corps orders were frequently dictated at divisional headquarters and forwarded to the units concerned by telephone.

13. The real weight of the fighting rests on the shoulders of the divisional commanders, on whom devolves full responsibility for the maintenance of their sectors. Divisional commanders must, therefore, be given control of all the organs of action available in their sectors, with the exception of guns employed on special tasks and, in exceptional cases, corps artillery groups detailed for special long-range objectives. They must at the right time allot to their subordinate commanders both their own reserves and the reserves placed at their disposal by superior authority; these subordinate commanders must, in their turn, make local arrangements for the employment of these reserves on the battle field.

The divisional commander must exert a continuous and keen influence on the whole control of the action; this will be insured by accurate reconnaissances on the ground and by maintaining daily personal touch with his troops and their commanders.

14. Every higher commander must clearly recognize that every report from front to rear and every order from rear to front requires a very long time to reach its destination. During a defensive battle the fighting zone lies almost continuously under the enemy's intense artillery bombardment. It has been frequently found that orders take 8 to 10 hours to reach the front line from divisional headquarters. It has often proved of value to forward orders to reserves by staff officers in motor cars.

15. To carry out a well-ordered relief, it is of great importance that accurate and up-to-date maps and plans are handed over. These maps must show not only the details of the actual front and the distribution of the fighting material available, but must also include the area in rear (billeting facilities, condition of the roads and administrative arrangements). It is desirable that the arrangements for these maps should be controlled by the general staff officers allotted permanently to sectors.

D. INFANTRY AND MACHINE GUNS.

I. Causes of initial failures.

16. The reasons for our previous failures arose not so much in the domain of purely infantry considerations as from our inability at the outset to make equivalent reply to the enemy's concentrations, more especially of aircraft and artillery.

At the commencement of the battle telephone lines which worked perfectly well in quiet times were at once cut, and only a small supply of apparatus for visual signaling and wireless was available. The transmission of information was consequently faulty and resulted frequently in the total isolation of the higher command and in the absence of all cooperation between the various arms.

The infantry, heavily engaged, were often left to their own devices for hours and days at a time, or else the front-line trenches would be crammed with troops owing to the ignorance of the situation that prevailed in rear. This entailed unnecessary casualties, and the moral effect was bad. This state of

affairs was aggravated by the enemy's superiority in the air, which at first was incontestable. Not only did the enemy's airmen direct the artillery fire undisturbed, but by day and by night they harassed our infantry with bombs and machine guns, in their trenches and shell holes, as well as on the march to and from the trenches. Even although the losses thus caused were comparatively small, their occurrence had an extremely lowering effect on the *morale* of the troops, who at first were helpless. The innumerable balloons, hanging like grapes in clusters over the enemy's lines, produced a similar effect, for the troops thought that individual men and machine guns could be picked up and watched by them and subjected to fire with observation.

17. On long stretches of front the small forces which were at first available were not distributed sufficiently in depth. The consequent feeling of uncertainty experienced by commanders led them not infrequently, in their determination to hold the front line at all costs, to reinforce the front line prematurely, to crowd it unnecessarily, and, on the other hand, to leave the rearward trenches unoccupied.

This failure to distribute the infantry in depth went hand in hand with a trench system of insufficient depth, a scarcity of serviceable positions in rear, and a shortage of labor.

The impossibility of regular reliefs made it necessary to overtax the strength of the infantry.

The first reinforcements to dribble in could only fill the largest gaps. Even the infantry of freshly assigned divisions had to be thrown into the fight unit by unit as soon as each arrived, or else were pushed up to take over in too great a hurry from utterly exhausted troops. The consequence was that portions of the positions were not infrequently lost.

18. Many units, more especially those coming from quiet parts of the front, lacked training and fighting experience. Not infrequently the fighting efficiency of the infantry suffered from faulty arrangements made within the regiments for bringing up rations, ammunition, etc.

II. Measures by which a gradual improvement was attained.

19. As the allotment of artillery ammunition, aeroplanes, and antiaircraft sections increased and steps were taken for machine guns to engage aviators flying low, the infantryman's

lot began to improve. His self-confidence returned and his fighting efficiency increased. Command and cooperation between all arms were greatly assisted by the provision of large quantities of means of communication and the reorganization of the reporting and communication systems.

20. Barrage zones were made deep and narrow, and behind them the infantry lines could be lightly held. The fact of pushing in a number of divisions led to narrower fronts and greater distribution in depth. The allotment of fresh divisions in rapid succession made timely and regular reliefs possible, and finally reached such a point that reserves behind the front could be trained in the light of the most recent experience and could be employed on the construction of rearward positions.

21. The progressive completion of positions made it possible to apply the lessons of recent experience (defense of an area with numerous trenches and switch lines, rational distribution, and siting of dugouts).

22. The fact of organizing supplies within regiments before they went into line, in the light of the experience of troops already relieved (formation of fourth platoons, organization of special carrying parties, provision of intermediate depots of rations, ammunitions, etc.), kept the infantry up to fighting standard for a longer period when in line and economized the employment of other units. In this way, again, methodical counterattacks could be made by fresh troops.

III. Experiences and lessons.

(Based chiefly on reports from the troops.)

(a) GENERAL.

23. *Our infantry is superior to that of the enemy.*—In the Somme Battle wherever the enemy gained the upper hand it was chiefly due to the perfected application of technical means, in particular to the employment of guns and ammunition in quantities which had been hitherto inconceivable. It was also due to the exemplary manner in which infantry, artillery, and aeroplanes cooperated. After artillery preparation, wherever the enemy's infantry, following up the last shell, came upon positions that were still held, the attack usually broke down, and if the advance was made against positions already destroyed the infantry could be ejected by determined and rapidly executed counterattacks.

The duty of every infantry commander is, firstly, to train and educate the infantry soldier for this hand-to-hand fighting (which should not be a privilege reserved for assault units, but should be a universal one); next, and more difficult, to keep him physically and mentally fit to fight both before and during an engagement; and, lastly, the most difficult of all, to get his men out of their shelters and dugouts in time and launch them against the enemy.

(b) TRAINING.

24. In this war, which is apparently dominated by science and numbers, individual will power is, nevertheless, the ultimate deciding factor.

The defense of a position depends more than it ever did before on the unshakable determination of the subordinate commander and of each individual man to hold his position.

25. It is a sound principle to keep troops intended for use on a certain battle front behind this front for about 14 days to enable them to complete their training. In this manner immediate advantage can be taken of the lessons of the most recent fighting, while at the same time commanders can familiarize themselves with the ground on which they are to be employed and with the special features of operations in that locality.

26. Apart from the general regulations in force, the instructions laid down for assault formations form the best guide for the training of the infantry soldier.

Physical fitness and confidence in his arms (rifle, hand grenade, spade, etc.) must be increased by constant practice. self-confidence and resolute determination are a guaranty of success, even against a numerically superior opponent.

27. The education and training of subordinate commanders is of particular importance.

To come supreme through the crises which even the best-trained infantry will undergo when suddenly experiencing such overwhelming mental and physical sensations, especially when torn from quiet trench warfare and hurled into a battle like that of the Somme, to combat the demoralizing effect that results from continuously remaining in shell holes and craters, requires whole-hearted disinterestedness and self-sacrificing care for subordinates, particularly on the part of company, platoon, and subordinate commanders.

The fighting value of troops depends on the standard of training attained by the men and on the military proficiency of the subordinate commanders.

28. The following are the most important branches of training:

(*a*) The education of the group[1] commander and of the individual private to the highest possible degree of self-reliance. (In positions which often consist of unconnected shell holes control by platoon and company commanders is rendered extremely difficult.)

(*b*) The training of every single man of the infantry in the use of all patterns of German hand grenades.

(*c*) The training of the greatest possible number of men in the use of captured hand grenades.

(*d*) An increase in the personnel trained in the use of our own and of the enemy's machine guns. Every infantry officer must be able to work a German machine gun. The gun crews must be drilled until, when prepared for action, they can bring up an unloaded gun from the bottom of a dugout and be ready to open fire within 30 seconds. Special practice is required in the use of improvised mountings and sandbag supports.

(*e*) Patrol work.

(*f*) Rapid counterattack across open ground, launched on the initiative of a subordinate commander, down to a group commander or some stout-hearted man.

(*g*) Methodical counterattack, following an artillery preparation.

(*h*) Rapid organization of shell holes for defense (to be connected as soon as possible by an irregular trench so as to facilitate command).

(*i*) The passage of areas which are under heavy shell fire (in file, lines of skirmishers, small parties).

(*k*) Behavior under intense bombardment in incompleted trenches (taking cover in shell holes in advance of the line).

(*l*) Practice in cooperating with artillery and with infantry aeroplanes.

(*m*) Training of regimental and headquarters communication sections.

Where a unit is to be employed for a special operation, it is advisable to train it in specially constructed practice trenches, and the details of the tasks allotted to it should be thoroughly practiced.

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[1] A group consists of eight men under a noncommissioned officer.—G S.

(C) RELIEFS.

29. It is often contended that as fresh troops are coming into the line a relief means a period of increased strength, whereas, on the contrary, it usually means a temporary weakness. What really is of vital importance during a relief is not the number of units in front line, but solely that the arrangements made for responsibility and command are clearly defined and that order and close supervision are maintained.

For these reasons, reliefs must be organized carefully, thoroughly, and in ample time.

30. The conduct of reliefs must be in the hands of the outgoing staff.

Before moving in units must be provided with everything (equipment, clothing, rations, close-range weapons, maps, signal stores, tracing tape, etc.) that they will require during the time they are employed in the front line.

The commanders of incoming troops will be given an opportunity of getting into touch with the infantry, pioneer, and artillery commanders of the outgoing troops, and of reconnoitering the ground.

Advance parties of the relieving troops (including machine-gun units) must be sent on ahead as early as possible to the position to be taken over. Rear parties of the outgoing troops will be retained for at least 24 hours. The chief duty of rear parties is to insure that no gaps occur in taking over the position and that touch is maintained with units on the flanks. Both parties will be commanded by officers.

Depressions, ravines, sunken roads, small woods or isolated farms should not be chosen as boundaries between sectors, for, being uually exposed to heavy shell fire, they call for special precautionary measures (construction of entanglements, distribution of troops in depth, flanking fire from machine guns).

31. Fresh troops will be led up by the most reliable guides of the outgoing garrison. These guides must be capable of making suggestions as to the formation to be adopted at different points (file, lines of skirmishers, or small parties). Delays, crossings and blocks occasion unnecessary losses and have a depressing influence on the troops.

Communication trenches are best marked by signboards of the type shown below.


Triangle trench.


Ball trench.


Cross trench.


Rectangle trench.

32. If commanders and advance parties have already become acquainted with the ground, the trenches, and the enemy's characteristics, portions of the front line can be relieved during the first night without cause for anxiety. This has the advantage that fresh troops come into the front line. If it has not been possible to make sufficiently detailed arrangements for the relief, it is advisable to relieve only portions of the supports during the first night.

Liaison and order are best guaranteed by pushing in the fresh troops checkerwise among the outgoing troops, thus relieving during the first night parties on the flanks in the front line and those in the center in the support line.

Where positions merely consist of shell holes, the front line and the flanks of the position should be marked out with tape.

It considerably stiffens incoming troops in their first uncertainty if the machine-gun units are relieved 24 hours later than the infantry.

The exchange of machine guns should be avoided, but ammunition, water buckets, etc., may be handed over.

33. The nerves and endurance even of the best troops have their limits, so that timely reliefs are absolutely essential. The utter exhaustion of troops in action usually culminates in the loss of the position. Worn-out troops are incapable of strenuous efforts for months afterwards. To rush troops into action as reinforcements at the last moment is to engage them under the most trying conditions; they will generally be used up in a very short period, without there being any possibility of their saving the position, owing to their ignorance of the ground.

34. Every endeavor must be made to procure a thorough rest outside the shelled area for troops that have been relieved. Only thus can troops regain their fighting efficiency and become fit for further employment.

(d) DISTRIBUTION.

35. The distribution of the infantry depends on battle conditions and especially on the efficacy of the enemy's artillery. It is also affected by the ground and by the nature of the positions available.

36. The fire for effect which precedes the enemy's great attacks and lasts for days, frequently rising to an intense bombardment, soon converts the front-line trenches into a succession of shell holes. This becomes a permanent state of affairs where frequent attacks preceded by violent bombardments follow each other in rapid succession. This hurricane of fire, which is intended to clear the way for the enemy's infantry, sweeps right over the area occupied by the supports. The barrage zone established by the enemy behind his objective adds to the difficulty of bringing up reserves from the rear. The infantry battle will, therefore, usually have to be decided by the troops up in the front, who are completely isolated. Hence the necessity for distribution in depth. To avoid unnecessary losses from the intense bombardment, the front line will be held as lightly as possible. One man for every 4 to 6 yards of front will suffice if the supports can be accommodated close behind the front line. To compensate for this, the strength of the defense must lie in distribution in depth.

37. The distribution of the troops must be such that in all circumstances the struggle for the position can be fought out in the front line without bringing up appreciable reserves from farther in rear. Supports, posted behind the front line either in squads or in open formation, can only reach this line in time if they are close behind it.

38. If possible, units will not be mixed, for at a critical juncture small forces in the front line led by commanders that the men know are preferable to a medley of detachments, hurriedly engaged, who are strange to each other.

It is preferable to engage units side by side, so that they can be distributed in depth in narrow sectors, rather than engage them one behind the other. The same system of reinforcing from the rear applies equally to bringing up supplies and replacing casualties. It has proved sound to form for this purpose fourth platoons from the companies engaged and to keep them in reserve.

39. Machine guns, for the employment of which the infantry sector commander (battalion or regimental commander) is re-

sponsible, will be spread over the zone of defense on the principle of distribution in depth.

Machine guns should be sparingly employed in the front-line trench, where they will generally be prematurely put out of action by the intense bombardment. They will seldom have a good frontal field of fire in positions which are sited on reverse slopes; flanking effect should consequently be employed. Their effect is to be supplemented by that of machine guns sited in pairs farther in rear, as far as possible in commanding positions, in such a manner that zones of fire can be formed both in front of and within defended area.

40. The experience of the Somme Battle teaches that an infantry regiment which has one battalion in front line, one in support, and one in reserve, can hold a front of about 800 meters for some 14 days in a defensive battle. After this period relief is generally necessary.

(e) CONSTRUCTION OF POSITIONS.

41. The measures required in the construction of positions have as their basis the necessity of having infantry organized in depth and of maintaining the garrison of the position ready for action.

42. In laying out new and in improving existing positions the infantry line must be traced to accord with the situation of the artillery observation posts. The principal artillery observation posts must not be exposed to fire directed on the infantry line. The dust and smoke and the moral effect on the observer, if posted in the infantry line, render observation in it difficult, if not impossible. An observer is useless if his means of communication are broken.

43. The front infantry trenches are well placed if they are situated on a reverse slope out of sight of the ground observation of the enemy's artillery and are overlooked directly by their own artillery observers from a position at least 550 yards in rear. At the same time these observers should be able to see well into the ground over which the enemy must attack for at least 200 yards in front of their own wire, and it should be possible to overlook, either from the front or a flank, at least a part of the ground behind this belt over which the enemy must make his approach marches. A very short field of fire is sufficient for the infantry. A line of this nature in undulating

country will be generally a reverse-slope position. If the enemy breaks into such a reverse-slope position, his infantry will have to fight exposed to our concentric, well-observed, and most effective fire, without the support of artillery which is assisted by ground observation.

44. For an obstinate defense of the front position it is not sufficient to dig a few parallel lines of trenches one behind another; a broad defensive zone must be constructed, composed of a network of trenches disposed in depth, with plenty of switches and cross trenches. Every fire trench, communication trench, and approach trench must, no matter in what direction it leads, be prepared for defense at least on one side, and be provided with an obstacle and dugouts for its garrison or assault detachment. An enemy who penetrates the front line of trenches must find himself opposed not only in front but in flank at the next line, and it must be possible to counterattack him from all sides. If he can not be turned out at once, he will at least be bottled up in a pocket, and thus the best condition for a deliberately planned counterattack will be created.

45. Even a position formed of broad, deep, defensive zones is not enough to stop the attempts of a strong enemy to break through, if he has made careful preparations. The power of concentrated artillery fire is so great that losses of ground will be inevitable even in the finest positions. Behind the front position, therefore, there must be at least two rearward positions, spaced so far apart from one another that the enemy will be compelled to change the position of his artillery in order to attack them. It must be a fixed principle in battle that as many new positions are organized behind as positions are lost in front.

46. It is desirable in constructing new positions that have to be organized during a battle to begin by making an entanglement in advance of the front fighting line, and simultaneously to commence the dugouts of the second line. From this framework a position of two lines will gradually be developed. The trenches themselves come last.

47. In addition to the continuous rearward positions, all localities for about 9 miles behind the front line of trenches must be organized for defense. In connection with this, all available shell-proof cellars must be converted into dugouts and provided with the necessary number of entrances. As far as possible, machine-gun emplacements should be provided to sweep the ground between the localities.

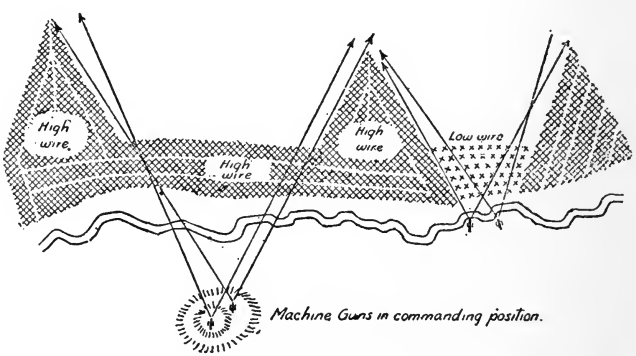
48. In the front trenches of a position only sufficient shell-proof dugouts are required as will shelter the garrison, which should be kept as weak in numbers as can be. In the rearward trenches it is hardly possible to make too many dugouts for the mass of the infantry. The following conditions have proved most suitable: 24 to 33 feet of earth or 5 feet of concrete overhead cover; at least two entrances a good distance apart; chambers for 10 to 20 men.

The deeper the dugouts the more important are a good, wide entanglement, continuous observation of the foreground, and reliable alarms. Dugouts without these precautions are mere man traps.

The construction of dugouts is absolutely indispensable along lines of approach for the temporary shelter of reliefs and carrying parties if caught by shell fire, in the communication trenches, for runners, and along the route of cable trenches for the linemen.

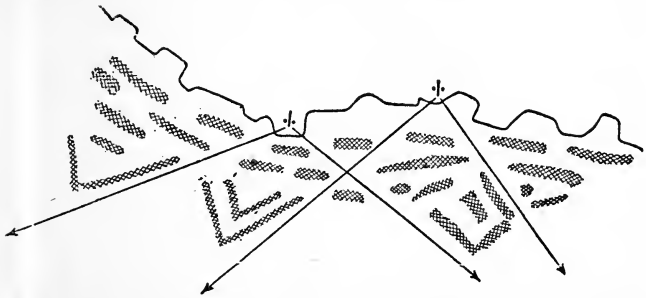
49. Entanglements in advance of the front trenches must be as strong as possible, must be erected in regular lines, and must cover wide spaces of ground for 60 to 200 yards in depth. This will force the enemy to an enormous expenditure of ammunition to destroy them, and will insure that, even after several days' wire cutting, he will still find a tangle of wood, wire, and iron in front of him.

The flanking of the front line of the entanglements by a suitable arrangement of machine-gun fire should not be overlooked.



To leave a free field for the counterattacks of the garrison of the rearward trenches, it is an advantage to arrange the entanglements of the rearward lines checkerwise. There must be

plenty of material ready to block the gaps (knife rests and concertinas).



50. The construction of infantry observation posts, command posts, and latrines is of special importance, as are also bombproof[1] shelters for ammunition, weapons for close combat (grenades, etc.), supplies, water tanks, and kitchens in the rearward trenches and support positions.

Built-up machine-gun emplacements are soon smashed to pieces unless they are shellproof (against heavy artillery). As a rule, the best course is to provide shellproof[1] shelters for the machine guns in which they are to be kept until required for action, when they are fired over the parapet.

Covered battle emplacements of concrete or armor plates are usually only possible on steep reverse slopes. They must not be conspicuously high.

In view of the importance of signal communications, special dugouts are necessary for them. These should be suited to their various natures (telephone offices, visual signaling, trench wireless, power buzzer, and listening sets).

Open cable trenches have proved more serviceable than buried cable, as the difficulty of repairing the latter is very great.

51. A well-considered scheme and plenty of dugout dressing stations are required for the care of the wounded. For periods of special activity there must be at least one medical dugout in each company sector. It should be built in the immediate vicinity of the second (support) trench, be large enough to accommodate 14 men lying down, and must be bombproof.[1]

[1] In the second edition of "Stellungsbau," dated 15/12/16, *bombensicher* (bombproof) is defined as proof against continuous bombardment by 8-inch howitzers and heavy trench mortars, and against single hits by heavier natures; *schussicher* (shellproof) as proof against continuous bombardment by 6-inch howitzers.—G. S. I.

There must also be sufficient space for the Medical Corps personnel, first-aid dressings, trench stretchers, blankets, mineral water, disinfecting material, reserve antigas material, supplies, etc. There should be larger medical dugouts capable of holding 25 to 40 men and a larger quantity of medical stores in the vicinity of the battalion reserve. In each regimental sector dugouts should be arranged about 2,000 to 3,000 yards behind the front line (cellars are most suitable, in each of which about 100 wounded can be accommodated lying down). The entrances, of which there should be at least two, of all medical dugouts, must be constructed so that stretchers can be easily carried in and out.

52. Defensive positions formed by connecting shell holes, which are the rule in the front line during heavy fighting, have the advantage that they are difficult to recognize and are correspondingly less effectively shelled. Infantry, therefore, feels safe in them, and is disinclined to dig the more easily seen continuous trenches. The advantages of shell-hole positions are, however, practically negligible in comparison with the following disadvantages:

Lack of accurate definition of the firing line; continual changes in the position of the line; uncertainty when arranging barrage fire; increased difficulty, if not absolute impossibility, of control of the men; nearly complete absence of any kind of leading, which makes itself particularly noticeable as the men are so dispersed, and nearly always involves loss of ground and casualties in missing; more rapid expenditure of the physical power of the men, for they can not shelter themselves from weather in the shell holes, and in heavy rain are often up to the waist in mud, whereas in continuous trenches some sort of drainage can be arranged quickly. In shell-hole positions, in which obstacles are generally lacking, the scattered groups are exposed to any surprise by hostile patrols, and a counterattack lacks supporting points and jumping-off trenches.

Rules can hardly be laid down for the construction of shell-hole positions during the fight. The obvious procedure here is at once to establish nests of infantry consisting of one or two groups, supported, if circumstances render it advisable, by one or two machine guns in or behind the line of shell holes occupied, and to construct obstacles and dugouts for them. By degrees these nests are linked up with one another and with the switch trenches and retired positions behind them.

(f) DEFENSE.

53. An active conduct of the defense is absolutely essential even against an enemy who is far superior in numbers. Intense activity of patrols and raids on weak points of the enemy's position interfere with his preparations for attack and compel him to keep in a condition of continual readiness for our attacks, and so to hold his positions more strongly even at times when he is not contemplating an attack himself.

54. In shell-hole positions, in which the infantry finds but little shelter from the enemy's fire, an active defense is of greater importance. Every man must understand that the losses caused by the enemy's artillery fire diminish, the closer our front lines are to those of the enemy. The completion of the position should, therefore, be combined with a pushing forward of our lines where the situation permits.

55. It is the task of the artillery and of the *minenwerfer* to nip the enemy's attack in the bud as far as possible. If the enemy none the less succeeds in leaving his trenches for the assault, it should be possible to repulse every attack by holding the front line with a weak garrison, provided with some machine guns and a large supply of close-range weapons, in combination with well-directed and rapidly opened barrage fire, and also with machine guns sited on points of rising ground farther in rear.

56. It is absolutely essential to remember that in spite of "defended areas" the fighting must take place in the foremost line and, if this is overrun, for its recapture.

57. The necessary preliminary for the repulse of a hostile attack is that our own infantry, distributed in depth, shall be kept fit for fighting in spite of effective and intense bombardment for days by the enemy's artillery. Continual work on the positions, and a good organization of the supply of rations and ammunition, are the most important points in maintaining their fighting strength.

58. As a matter of principle, every unit must fight in that portion of the foremost position which is given to it to defend.

The voluntary evacuation of a position, or of portions of a position, can lead to most disastrous results for the troops on the flanks. The voluntary evacuation of positions must, therefore, only take place with the express permission of the higher

commanders, who are in a position to realize its effects on the troops on the flanks and on other arms (artillery).

59. Such an evacuation can scarcely ever be carried out methodically except by night or in very misty weather, for experience shows that during the fighting every visible movement by day is immediately subjected to the most intense fire, and all movements cause heavy losses owing to the fact that communication trenches are usually entirely lacking.

60. No objection can be taken to the temporary evacuation in a forward direction of portions of the foremost line which are exposed to very heavy shell fire in the case of good troops who are well trained in initiative and in rapid counterattack. The movement will then consist in individual groups dashing forward into shell holes which lie in front of their position.

61. A movement to the flank under hostile fire can only be carried out on a very narrow front, and then by moving quickly from crater to crater, or by creeping along the remains of the trenches. During the battle the front covered by the enemy's intense bombardment will usually be so broad that nothing is gained by moving the trench garrison to the flank. The maneuver, however, is always exposed to the great risk that the enemy observes the evacuation, lifts his fire farther forward, and immediately occupies the position which has been evacuated.

62. The risk is very much increased if the garrison of a trench retires from its foremost line. All intense artillery fire, even if directed against a narrow front, covers the ground in rear. As a general rule, all lines which lie behind the foremost trenches are methodically shelled. If our trench garrison moves to the rear in the zone of fire, it quickly becomes demoralized. All experience proves that such troops can no longer be expected to carry out a counterattack. The result is almost invariably the loss of the portion of the position which has been evacuated and, as a further result, the creation of a very difficult position for the troops on the flanks. These, if the enemy attacks on a broader front, are usually attacked frontally and on the flank, and have to fight under the most unfavorable conditions.

63. During the Battle of the Somme the methodical evacuation of portions of the position depended on obtaining permission from army headquarters, and every evacuation of positions, even to the smallest extent, carried out on the responsibility of the individual commander, was forbidden. Every man was

obliged to fight at that point at which he was stationed; the enemy's line of advance could only lead over his dead body. Army headquarters believes that it was owing to this firm determination to fight, with which every leader was inspired, that the enemy, in spite of his superior numbers, bled to death in front of the serried ranks of our soldiers.

64. If the enemy succeeds in overrunning the front lines in an attack, he can only be ejected by immediate counterattacks which must envelop him on all sides. If he has once managed to consolidate his hold on our positions, a methodical counterattack, which takes time, is necessary.

65. Penetration of our lines by the enemy occurs during the battle not only in the case of attacks, which are carefully prepared, but is frequently effected by patrols or small detachments with machine guns which penetrate or sap their way into gaps, particularly in shell-hole positions. These small detachments are gradually followed by larger forces. This kind of "nest" is often scarcely noticed to begin with, or does not have sufficient attention paid to it. The seriousness of the situation is usually first recognized when it is too late. Instead of cutting off the "nest" or countering it by a vigorous attack, a methodical attack has to be made.

The necessary preparations for methodical attacks on nests of this kind must be made at once, as soon as the nest is discovered. The most important are to reconnoiter the position as quickly as possible, to block the nest off on all sides, so that a shell hole is occupied at once as close as possible behind the breach. A trench should then be dug leading to the shell hole. Other trenches should be dug in which assault detachments can be assembled; patrols should feel their way toward the flanks of the enemy who has penetrated our position and should dig themselves in. Every available means to assist in the attack should be carefully concentrated, such as assault detachments, *Flammenwerfer*, *Granatenwerfer*, light *Minenwerfer*, infantry gun batteries, etc.

(g) IMMEDIATE AND METHODICAL COUNTERATTACKS.

66. An immediate counterattack can scarcely ever be ordered by the higher commanders. It must be the result of the quick initiative of the commanders, subordinate commanders, and men in the front line. Every man must be trained to eject, on his own initiative, an enemy who has penetrated our positions,

and not to rest content until the foremost line has been entirely cleared. Quick, mobile bombing parties, moving rapidly over the open or along the trenches, vie with assault detachments specially distributed and allotted to special objectives. The commanders of the supports must take in the situation and make up their minds quickly and attack the enemy, distributing their groups, platoons, and companies to meet the situation, allotting special tasks to detachments and giving them short and precise instructions as to objectives. For this purpose it is necessary that the quarters of supports and reserves, when the fighting develops its full intensity, should be distributed over different points in the ground (in trenches and dugouts or on the slopes of hills). The collection of numbers of dugouts or camps at one point will not escape the enemy's notice; by opening heavy fire on such points he puts the massed supports accommodated there out of action at the critical moment.

It is very important that, in addition to the transmission of information from front to rear, communication should also be established from rear to front. Troops which wait for reports to reach them from the front will always come up too late for a counterattack. Continual observation of our own and the enemy's positions is absolutely essential on the part of the sentries of the supports and reserves. Commanders must keep themselves continually informed as to the situation and at critical moments keep a lookout themselves, for only thus can they have a clear idea of what is happening and come to quick and correct decisions.

67. The execution of methodical counterattacks can not be dispensed with even in a purely defensive battle. They are necessary in order to recapture important points which have been lost, or at least not to leave the enemy full freedom of action. If they are well prepared, they do not involve more casualties or a greater expenditure of ammunition than do passive endurance of an intense bombardment and numerous unnecessary requests for barrage fire, which become more frequent as the self-confidence of the troops diminishes as a result of adopting a purely passive attitude.

In every attack, rearward positions, strong points, and flanking positions must be held by emergency garrisons as a precaution against possible defeats.

68. Methodical attacks may either be carried out as surprise attacks without artillery preparation or with the employment

of intense artillery preparation. A compromise between the two methods nearly always leads to failure.

69. Surprise attacks should be limited to a narrow front, and can only be carried out if the habits of the enemy are exactly known, if the approach to the enemy's position is short and free of obstacles, and if it is possible to penetrate into the enemy's position at several points simultaneously and with practically no casualties. Thorough rehearsals, a detailed allotment of tasks down to individuals, taking full advantage of the weather (e. g., mist or twilight), and simultaneous and rapid action are preliminary conditions necessary for the success of a surprise attack.

70. Raids on a larger scale will, as a rule, only be successful after intense artillery preparation. The preparatory measures to be carried out by the artillery (accurate registration on all the targets which are to be shelled in the course of the raid) and the expenditure of ammunition must be so regulated that the portions of positions to be captured are really shelled into a condition in which they are ready to be assaulted. It will often be necessary to evacuate our own front lines during the fire for effect; this can be done without hesitation if our artillery fire is properly directed against the enemy's trenches.

71. Troops who have been lying widely scattered in trenches which have been destroyed and in shell holes, with insufficient food, and who are longing for the day when they will be relieved, will only be induced to attack cheerfully and resolutely at a fixed time, without the possibility of being thoroughly instructed as to the reasons and objective of the attack, if their leaders are extraordinarily efficient, and then only, as a rule, in driblets. A necessary preliminary for a successful attack on a large scale is fresh infantry to make the assault (a regiment to every 1,000 yards of front) and the detailing of a relief for the assault troops. The original troops in the line may be employed for this purpose if they have not been exhausted by previous fighting.

72. It is advisable not to relieve the troops who have made a successful assault immediately, but two or three days later. Troops who have won ground after heavy fighting will hold the captured position more tenaciously than new troops who also, in many cases, do not know the ground sufficiently well.

To avoid any weakening during these two days of the troops who have made the assault, special parties, commanded by offi-

cers, must be detailed to evacuate prisoners and wounded, to clear the ground and, above all, to bring up supplies of building material. Thorough and special infantry preparations for this work are necessary, even with well-trained troops.

Machine guns form a support and protection for the assaulting troops in immediate and methodical counterattacks and hold the enemy to his trenches by flanking fire, especially at the moment when the assaulting troops leave their trenches. The section commanders of the machine guns specially detailed beforehand to follow up the assault, advance with the assaulting infantry so as to reconnoiter the captured position at once for suitable gun positions.

Machine guns should be brought up to the captured position as soon as the infantry has taken it. They must be dug in before a hostile counterattack is delivered or the enemy's annihilating fire is opened against the captured position. To bring up machine guns from the lines in rear into the position from which the attack is to be made, and thence to the captured trenches, demands thorough reconnaissance and clear orders as to time, route, objective, and duties.

It is advisable to detail a few infantrymen to the machine guns to act under the order of the section commander. Their duties are to protect the machine guns, to defend it in hand-to-hand fighting (hand grenades), to help in digging in the gun in the captured trench, and to dig connecting trenches in shell-hole positions.

73. The basis for the preparations for the attack is thorough reconnaissance of the enemy's position by patrols, observers, and aeroplane photographs. The nature of the ground, the trace of the enemy's trenches, the condition and nature of his entanglements, the situation of dugouts, machine guns and trench guns, the degree of the enemy's vigilance are factors which demand thorough reconnaissance and must be taken into consideration in deciding on the manner in which the attack is to be carried out.

The well-considered employment of all technical means and close cooperation of the artillery with the infantry and of the airmen with the artillery and infantry require the nicest adjustment of arrangements as regards both time and space. If a hostile position has been conquered by technical means, all the infantry has to do is to occupy it. It is advisable to issue good maps (1:5,000), specially prepared for the operations and

containing all the information gained by reconnaissance, and to distribute them down to group commanders.

74. While the troops in the front-line trenches are preparing the starting point for the attack (which is absolutely essential and should consist, if possible, of several trenches with dugouts) the troops who are to deliver the attack should be kept in rear, with good rations and quarters, and trained on a practice defense work which resembles the actual position to be attacked as closely as possible. The detailing of special assault detachments which are to deal entirely with machine guns which have not been put out of action has proved to be very effective. It is necessary to practice the individual detachments—even the individual men—in the tasks allotted to them again and again.

Feint preparations for an attack in the neighborhood of the front which is to be attacked, the employment of gas or smoke bombs, machine-gun and *Flammenwerfer* activity, in combination with bursts of artillery fire and unusual aerial activity, leave the enemy in doubt as to the actual point to be attacked and cause him to distribute his artillery fire.

75. The attack should not go beyond the objective unless a complete understanding has been arrived at with the artillery.

At the moment for the attack, which, if possible, should not be made evident by increased intensity of artillery fire, the most important point is for all detachments and waves of assault to leave the trenches simultaneously and sufficiently rapidly to avoid the enemy's barrage fire and to prevent any of the enemy's machine guns which have not been put out of action from opening fire. Once the waves of assault have forced their way into the enemy's first line, they have nothing to fear from the enemy's destructive or barrage fire, but can deal with the enemy's infantry without interference.

76. Counterthrusts and counterattacks are still too seldom employed as a means of escaping from the enemy's fire for effect and taking advantage of the moral superiority of our own infantry. Troops who have lain passively under intense artillery fire leave the first line with a greater loss of *morale* than a unit which has carried out a counterattack, even if this is only partially successful.

(h) EQUIPMENT.

77. The steel helmet has proved thoroughly satisfactory and is very popular. To diminish the polish of the helmet, which

remains bright in spite of the gray paint, it has been found useful to smear the helmet with clay and earth.

78. Assault kit must be supplemented by sand bags carried like a rucksack, which serve to carry up rations and ammunition in place of the pack, which is too heavy. It is always advisable to take greatcoats and waterproof sheets. Blankets are only necessary in cold weather.

One hundred and fifty cartridges per man are enough. Before the men go into action it is necessary to issue large numbers of hand grenades in sandbags and to equip every man with a large spade (every section with a pickax, pioneer, and building material) as well as with cold rations for three or four days.

79. On days when there is heavy fighting, the demand for food is not so great as that for something to drink. It is necessary to equip the men with two water bottles full of tea or coffee, and to issue several bottles of mineral water, as well as to avoid all food which causes thirst (no salted or smoked meat). Bacon, sausage which will keep, bread, rusks, biscuits, chocolate, tinned meat and tinned fat are recommended. No rations must be issued in larger packages than half-packages, so as to make each man independent of the others. Tobacco and cigars in fairly large quantities are a very welcome supplement, as also is alcohol in wet, cold weather. To avoid the misuse of concentrated alcohol, it is advisable to mix rum or red wine with the tea. It has proved very useful to issue solidified methylated spirits to warm up tinned food and the food sent up from the traveling kitchens. It is absolutely necessary to issue illuminating materials such as candles, carbide and electric lamps with spare batteries.

80. To keep the rifle from getting dirty, it is a good plan to wrap waterproof cloth around the breech.

Orderlies, runners, and carrying parties are best armed with pistols, as the rifle gets in the men's way as they dash from one shell hole to another.

81. The issue of light pistols on the establishment scale is not sufficient for the requirements during a battle. It is necessary to increase the number of pistols and the amount of light-pistol ammunition before heavy fighting begins.

82. For machine-gun personnel the following equipment has proved useful in addition to the sandbag which is used for carrying stores.

(*a*) Gun teams of the strength of one noncommissioned officer and seven men.

Gun commander.—One water can, telescope attached to the belt, one reserve barrel in a roughly made wooden box or wrapped up in cloth or the waterproof sheet, one condenser tube, one spare lock in his trouser pocket, one folding cleaning rod and a pair of pliers in his sandbag.

No. 1: One auxiliary mounting, one light pistol and cartridges.

No. 2: The machine gun itself wrapped up in a tent square, tool bag attached to his belt, one spare lock in his trouser pocket.

Nos. 3 and 4: One ammunition box each containing 500 rounds; oil, grease, and tow in their sandbags.

Nos. 5, 6, and 7: One ammunition box each containing 500 rounds; hand grenades in their sandbags.

(*b*) Three section commanders with two orderlies each.

Section commander: Light pistol and cartridges, one water can.

First orderly: One water can and an oil can in his sand bag.

Second orderly: One water can, a belt filler in his sand bag.

(*c*) *Company commander.*

First orderly with a belt filler in his sand bag.

Second orderly: One oil can in his sand bag.

Third orderly: Tow and a belt filler in his sand bag.

One assistant armorer with a No. 11 tool box in his sand bag.

(i) SUPPLY.

83. The supply of rations, ammunition, and pioneer material must be organized down to the smallest details and controlled by officers. It is extraordinary how far forward wagons (and also traveling kitchens) can go under skillful and smart leadership without casualties, even on days when the artillery fire is intense. It has proved very useful to form fourth platoons and divide them up into carrying parties. All ammunition and rations which have to be brought up must be packed up by the carrying parties beforehand in their quarters in packages which can be easily handled and distributed. It is a good plan to pack the stores for each group in a few sand bags.

84. The widely spread idea that the troops in the foremost line do not care for hot food and prefer the cold rations which they take up with them is erroneous. It is true that the troops do not care for cooked food when it reaches them as a cold and greasy mess. On the other hand, it is absolutely necessary for the maintenance of the health and spirits of the troops, especially in wet and cold weather, to do everything possible to bring up something hot to eat and drink to the men in the front trenches at least once a day. In places where the traveling kitchens can not come up close enough cooking places must be provided in the reserve and support trenches in which the food can be warmed up again en route. From these points the food should be sent on in handy light mess tins, which retain heat well and with which the carrier can throw himself down, in case the enemy opens fire, without spilling the food. Tightly-closing receptacles, shaped like a vintner's tub and carried like a pack, are strongly recommended.

85. To make the supply easier it is advisable to establish depots and intermediate depots of ammunition and rations in the second and third trenches and with the supports and reserves; these should be established beforehand, while things are quiet. It is also advisable to establish advanced clothing stores from which the troops can draw the most necessary articles of clothing and equipment, such as water bottles, stockings, foot bandages, and boots as quickly as possible, and to incorporate the company tradesmen in the fourth platoons (mentioned above).

86. The machine-gun officer on the regimental staff is responsible for the supply for the whole of the machine-gun units of an infantry regiment. He must arrange for the replacement and bringing up of equipment and ammunition and controls the supply of rations for the machine-gun detachments which, for this purpose, are best incorporated in the infantry companies with which they are working.

E. PIONEERS, SEARCHLIGHTS, "FLAMMENWERFER," AND TRENCH MORTARS.

87. The experience of the Somme Battle shows that the following staffs and troops are necessary:

STAFFS.

Pioneer general at army headquarters with one adjutant, one officer for pioneer services, one officer for *Minenwerfer* services,

and one senior officer with three subalterns for the supply of material.

Staff officer of pioneers with the groups (corps). Pioneer commander with each division; he also commands the pioneer battalions of the division and is the technical adviser of the divisional commander on all questions of the construction of defenses, *Minenwerfer*, and the employment of pioneers and *Minenwerfer*.

A senior, permanent pioneer officer with each division. He should be employed for the most part, under the pioneer commander, on the supply of engineer stores and weapons for the close combat, and, when the division is relieved, will disseminate all the experience gained.

TROOPS.

Four pioneer companies for each division, one for each of the three infantry regiments in the position and one at the disposal of the division for particular tasks. If there is mine warfare in the divisional sector one or two pioneer mining companies are also necessary.

One pioneer battalion at the disposal of the group for the completion of the back lines and for special tasks. A large number of landwehr and landsturm companies (about as many as there are divisional sectors) at the disposal of the army for the construction of additional back lines.

A pioneer park company for every pioneer park and two for the army pioneer park.

88. Divisional pioneer companies will be relieved with their divisions. Just as with the infantry, thorough instruction and preliminary training are necessary before moving into the position, which must be carefully handed over, both by means of maps and on the ground. If the commanders have a good knowledge of the position, the chances of ground being lost during the period immediately following the relief are minimized. It is, therefore, essential that the pioneer commander and the company commanders of the incoming division should be sent on several days beforehand with small advance parties and that rear parties of the outgoing division should remain behind in each regimental sector.

89. One searchlight section per division is sufficient. Detachments can be detailed from these sections for employment under group or army headquarters.

90. The attachment of *Flammenwerfer* to the assault troops is specially desirable when methodical counter attacks are to be carried out. Consequently one of the *Flammenwerfer* battalions allotted to the army was combined with an assault school, and, by means of small detachments, trained those divisions which were behind the front, waiting to act as reliefs, in the technical use of *Flammenwerfer*.

91. The requirements of an infantry division in a defensive battle have, on the whole, been met by the allotment of light *Minenwerfer* to infantry battalions, in addition to the divisional *Minenwerfer* company, as long as the army also has at its disposal a few *Minenwerfer* companies which can be engaged at decisive points. There is hardly likely to be any occasion to engage a *Minenwerfer* battalion as a complete unit on the actual battle front, but a vigorous and overwhelming bombardment by *Minenwerfer* on portions of the army front where no attack is being made can do considerable injury to the enemy.

92. In previously prepared positions trench mortars of all kinds can be employed; on the actual battle field, when there are no previously prepared positions, heavy and medium *Minenwerfer* can not be employed, owing to the difficulty of ammunition supply.

Light *Minenwerfer* can only be employed when cover is available. Their main tasks are annihilating and barrage fire.

93. *Minenwerfer* are best employed in groups of two to four mortars, in order to avoid overconcentration. The distance behind the front line should be such that they can not be overrun immediately the enemy penetrates into the position. Conspicuous points are to be avoided and every advantage should be taken of cover provided by the lie of the ground. Alternative emplacements are of value, provided ammunition supply is feasible and covered communications are available. Cooperation with infantry and artillery must be effected in accordance with a fixed scheme of targets and barrage fire.

F. ARTILLERY.

I. Causes of initial failures.

94. At the beginning of the Battle of the Somme our artillery was far too weak in numbers, in calibers, supply of ammunition, and means of observation to meet the enemy from the outset with the requisite counter measures. To this may be

added the quite noticeable inferiority of our reconnaissance, especially aerial reconnaissance, for which the enemy produced a very large number of machines, corresponding to his artillery equipment, and which doubtless also were well organized and employed.

95. Thus our infantry lacked the necessary artillery support. The result was a retrograde movement under pressure from the enemy, which made general supervision and a clear system of command even more difficult and caused the artillery also heavy losses in men and material. The ground on which systematic preparations had been made for the massed employment of reenforcing artillery, especially heavy artillery, was partly lost to the enemy, so that the rapid and smooth carrying out of reenforcement on a very large scale could no longer be insured. Practically all the reenforcing divisions came without their own artillery; thus there was a great mixture of formations, and consequently uniformity of action again suffered.

96. Under these difficult conditions the artillery reenforcements which were hurriedly brought up were thrown into line as they happened to arrive, wherever the situation seemed to be most serious. The batteries no longer found positions already dug and prepared. Under the enemy's fire they had to start everything from the beginning. Any fresh headquarters that were allotted had to be employed as quickly as possible wherever the need was greatest. This produced for a time a confusion of units, which was bound to react on the command of the artillery in the battle and necessarily decrease the effective work of the troops. The artillery was therefore only partially able to carry out its task in the defensive battle.

97. A systematic engagement of the enemy's artillery, of the enemy's points of departure, and of the troops waiting for the assault could not, in most cases, take place. Continual barrage fire, and nothing else, was regarded by the troops as the only salvation when on the defensive.

At the beginning of the battle the troops had not been made to see that barrage is simply a protective measure to hinder the enemy entering a certain strip of country in front of our own line, but that it does not do the enemy any damage if he does not run into this strip or is not surprised there. Thus by continual barrage fire, with its huge expenditure of ammunition and material and human energy, no real damage to the enemy is insured.

98. Owing to the noticeable lack of long-range flat-trajectory guns there was, from the outset, no possibility of a well thought out and systematic interference with the enemy's organizations behind his front of attack.

II. Measures by which a gradual improvement was attained.

99. An improvement in the situation only became possible after the arrival of considerable artillery reenforcements (especially heavy artillery) and of their auxiliaries (aeroplanes and kite balloons); it thus became possible to give the infantry defense more support. But with the loss of ground still continuing in spite of these measures, and the necessaray shifting of battle fronts owing to new divisions being engaged and new army groups being formed, it was only gradually possible to obtain an effective organization of the artillery command and intelligence.

100. Attention is called to the following points as the most important in the organization that arose:

(*a*) Provision of a separate artillery telephone system.

(*b*) A large increase of the previously well arranged survey system by forming an artillery survey section, where all results of reconnaissance could be sifted and issued on a daily artillery map, which served as the basis for artillery fire control. Close liaison with balloons and aeroplanes by connecting them up with the artillery telephone system.

(*c*) Equipment of field and heavy artillery with good maps and reliable battery boards.

(*d*) Expansion of the means of aerial reconnaissance and improvement of the cooperation between aeroplanes and artillery. Increased barrage protection against the enemy's aerial observers.

(*e*) Regulating the ammunition expenditure in accordance with the possibilities of supply and thus forming an assured reserve of ammunition.

(*f*) Employment of the ammunition parks within the groups to carry out the supply of material as well as that of ammunition.

(*g*) More careful supervision of the handling by the troops of material and ammunition. The erection of efficient repair workshops within the groups and of a large workshop for the whole army area.

(*h*) The following were also aimed at, but were obtained only partially or not at all during the battle, owing to the unfavorable circumstances:

The formation of a larger reserve of ammunition to make the army more independent of replenishment from the rear.

The most comprehensive engagement of the enemy's artillery and continual attacks on the enemy's rearward communications and billets.

The building of field tramways right up to the battery positions in order to insure a smooth ammunition supply, to spare the horses, and to use fewer motor lorries, thus saving the roads.

The construction and use of numerous alternative positions.

101. The results of these measures were soon shown by the fact that the troops recognized that barrage fire diminishes in importance if the enemy can be systematically engaged with artillery; that is, if proper attention is given to the engagement of the enemy's artillery and to destructive and annihilating fire. Thanks to a sharp lookout on the part of our troops, we were generally able to nip the enemy's attacks in the bud and thus decreased the number of useless calls for barrage. The more it was supported by the infantry, especially in exactly determining our own and the enemy's lines, the better were the results obtained by the artillery. Closer cooperation with the other means of observation, especially with the air service, produced further improvement in this respect. A considerable decrease in the expenditure of ammunition and material was attained, and yet our reverses diminished and finally ceased almost entirely.

III. Experiences and lessons.

(a) PREPARATIONS FOR THE BATTLE.

102. The employment of artillery reenforcements must be carried out on the basis of a scheme, thought over and worked out during quiet times, making full use of prepared battery positions, methods of command and observation, battery boards, and lists of targets. For this a type of armament plan, similar to those used in a fortress, must be prepared; it must include not only the front but also the back lines.

103. In addition there must be an artillery telephone system which is quite separate from the general tactical system. Where

the complete construction of such a system, which is desirable, does not appear to be possible or necessary in a quiet sector, the whole of the material must be available to be built in. Material brought by the newly arrived staffs and batteries is generally quite insufficient and should only be used in cases of urgent necessity.

Special safety measures are advisable for the most important communications between command posts and observation posts; these include placing the wire in special cable trenches, avoiding localities and prominent points on the ground which are known to be much shelled, and laying the double lines of cable, which must be placed well apart in the form of ladder circuits, etc.

104. All troops as they arrive should, if possible, be tested as to their fighting capacity. Troops that have suffered severely and are worn out by their exertions in other theaters of the war can not do what is expected of them. In general, their move into line will be hastened and more efficiently carried out if officers are sent on in advance. These latter can instruct the troops in the tasks that are allotted to them (battery positions, condition of the roads, billets), and at the same time hand over the necessary maps and plans.

105. A sufficient supply of ammunition must be kept ready within armies, and, if possible, within corps (groups) in order to be able to meet sudden demands quickly.

106. The supply in times of battle must be insured, even in the case of the roads becoming bad, etc., by the construction of a large number of field tramways.

107. It is necessary to erect large repair workshops, which must be able to form branches at short notice with the groups, if necessary, by making use of favorably situated and suitable armorers' workshops belonging to the troops.

(b) COMMAND.

108. In face of the frequently changing groups a certain permanency in command must be maintained if all useful experiences, etc., are not to be lost. The longer the command remains in the same hands the better.

This also applies to artillery commanders; the latter should not be changed in a shorter period than four weeks, even if their divisions are withdrawn sooner. A simultaneous change of the divisional commanders and the artillery commanders must be avoided in all circumstances.

109. The correct employment of the artillery calls for a well-conceived plan of action, in which the questions of the most suitable directions of fire and ranges, enfilade and oblique fire, increasing the density of fire and supporting neighboring sectors, cover and the state of the roads have all been carefully thought out and properly coordinated. When the tactical situation changes, all moves and changes of positions must be carried out in accordance with this plan.

It is often advisable to place batteries outside the divisional sector; neighboring divisions may only refuse their consent if they themselves have urgent need of the position.

110. As far as possible artillery brigades and battalions should only be put into line as complete units. Splitting up into single batteries doubtless leads, with officers and men of the present type (little experience, scanty training), to a distinct drop in fighting power in a battle. In addition, splitting up the units leads to difficulties of interior economy (preliminary and further training, clothing, equipment, condition of the horses, etc.).

111. It has proved advisable for purposes of command during the battle to concentrate the command posts of the divisional commander, the artillery commander, and the commander of the heavy artillery at the same place.

The increased length of the telephone wires from the artillery commander to the groups (*Abteilungen* battalions) is of no importance, as experience shows that the lines in the back area can always be maintained in working order without difficulty.

112. The continual presence of the commander of the troops at battle headquarters which give a good all-round view has very great disadvantages from the point of view of command during the battle. Excluding the fact that it is only in very rare cases that battle headquarters will allow of a view over the whole battle field, they entail an increased amount of personnel and material in buildings, which are generally quite inadequate for a properly conducted office organization, as the artillery commanders with their extensive system of telephone communications must be at battle headquarters with the commander of the troops. The shorter distance from the fire zone endangers communications and thus also the continuity of command in the battle; the latter also suffers from the continual moves between billets and battle headquarters. It will therefore, as a rule, be preferable if commanders of troops and their artillery commanders direct the battle from their billets, and insure that they are quickly informed of events in front line by officer observers

specially sent out and provided with independent communications (observing stations).

(c) TRAINING.

113. The training of the troops, especially in the case of the young officers and battery commanders, no longer reaches the standard formerly required. In particular, the results obtained in shooting by officers and acting officers, some of whom are inexperienced, have been insufficient. It has proved of practical value, when circumstances have permitted it, to discuss the general idea and execution of an important shoot beforehand, as well as subsequently to criticize the shoots that have been carried out, on the basis of the rounds recorded.

It is necessary to arrange for further training areas, where formations stationed in readiness as a reserve in the hands of the higher command, can stiffen their training. In these areas artillery schools and practice with live rounds must be arranged for; individuals belonging to troops in line will be detailed to attend such courses.

114. There must be a considerable improvement in the knowledge of the capabilities of the artillery amongst infantry officers. Not only the higher commanders but the subordinate infantry leaders down to the group[1] commanders must know the most important facts about the artillery. Instructions on this subject must take place during quiet periods, and should consist of lectures on artillery, the methods of fire and their object, and of actual examples of gun drill and observing station work. Every man will take an interest in this; his interest in the sister arm will be excited and cooperation between the two arms will consequently benefit.

115. According to our experience, reenforcements asked for from the depot units at home are very slow in arriving and sometimes come so late that the fighting power of the troops is endangered. To obviate this the formation of a special depot detachment behind the army front has proved valuable. Its object is to preserve the fighting efficiency of the troops in case of casualties occurring until the reenforcements from home arrive; at the same time it allows of more opportunity for rest than is possible in battery billets being given to men who are worn out or who need a rest, and avoids the necessity for sending them back to Germany. This depot detachment is also fitted,

[1] A group consists of eight men under a noncommissioned officer.—G. S.

on account of its better equipment with modern guns, to carry out the further instruction of reenforcements, which, according to our experience, are often quite insufficiently trained.

(d) ORGANIZATION.

113. If it is in any way possible, the fighting sectors of the field artillery groups should coincide with those of the infantry regiments. For this it is necessary for a group to be able to carry out all fighting tasks independently, and it must therefore consist of guns and light field howitzers mixed. Difficulties of interior economy must be put up with. A division into flat-trajectory and high-angle fire groups is unsuitable. The strength of a group must depend on the tactical situation. The formation of too small groups and the further splitting up into subgroups makes the issue of orders more difficult and slower.

117. Fire direction by the artillery group commander must be carried out on the actual ground from personal observation. Where this is impossible each group must have at least one auxiliary observer who can see over the battle field. It must be left to the decision of the group commander how he will carry out the various battle tasks allotted him and which batteries and guns he will make use of for certain tasks. This especially applies to the expenditure of ammunition. The artillery group commander must try to minimize the expenditure so that he may always have sufficient ammunition at hand for decisive movements.

118. The closest cooperation with the infantry will be obtained if the command posts are as close together as possible; this gives an opportunity for the two commanders to confer together (artillery group commander and infantry regimental commander). Such conferences will be supplemented or, in unfavorable local circumstances, replaced by artillery liaison officers, who must be provided with direct and safe telephone communications.

This mutual understanding will be increased by a continual exchange of observations, by frequent visits of artillery officers to the trenches, and by frequent visits of infantry officers to artillery observing stations.

119. The boundaries of infantry battle sectors are weak points in a position. The artillery must observe past them, and, by the closest liaison to right and left, must prevent them becoming actual dividing lines.

Cross communications are therefore necessary to the neighboring artillery commanders and group commanders and to their observing stations. The possibilities of effectice fire from neighboring sectors must be known and made use of for increasing the density of fire according to some prepared scheme.

Cooperation with a neighboring sector is not a favor but simply a duty from which only more urgent tasks on one's own sector can absolve one.

120. The question as to how far the artillery line should, as a general rule, be in rear of the most advanced infantry line needs special attention. The question of the most effective distance for barrage fire lays down a limit for the field artillery; batteries must not be more than 3,300 yards from the front line. Special tasks, such as enfilade fire on certain areas, may necessitate placing batteries considerably closer up.

121. Heavy artillery, especially when armed with flat-trajectory guns, must not be led away by its greater range into choosing battery positions farther in rear. The object in providing long-range guns is not to enable such batteries to avoid the enemy's fire more easily, but to make their effect felt far behind the enemy's line.

122. The same principles hold good for the employment of the very heavy flat-trajectory guns, in so far as their dependence on the railway lines does not from the outset force them into certain defined positions.

(e) CONSTRUCTION OF BATTERY POSITIONS.

123. A suitable choice of a battery position will save much labor in construction. A systematic scheme of construction is necessary; first cover from aeroplanes, then deep dugouts for the detachments, ammunition pits, communication trenches, and, finally, wire entanglements and preparations for infantry defense. Special attention must be paid to cover for the ammunition, which must be made absolutely proof against the enemy's fire and the weather. The ammunition dumps, which are some distance from the battery position and have to hold a second day's supply, will also need sufficient cover.

124. Gun pits require as large an arc of fire as possible. This must be taken into consideration when they are first built, as subsequent alterations are difficult and take much time.

125. It is important from the point of view of ammunition supply and change of position to keep the roads of approach in

a good state. The possibility of their being replaced or supplemented by means of field railways or tramways must be taken into consideration as soon as possible. If the ground is bad, they will have to be worked by men instead of horses to attain the necessary standard of efficiency.

126. Continual strengthening of the positions makes it possible for batteries to remain longer in them, even when they have been located by the enemy and are subjected to heavy fire. A change of position, with its disadvantages (loss of registration records and experiences gained, the necessity for fresh communications and registration), can thus be frequently avoided.

127. The construction of dummy and alternative positions is a valuable means of weakening the effect of the enemy's fire. The men required for such work can only partly be provided by the artillery and must be reinforced by parties detailed by other troops.

(f) FIRE CONTROL.

128. The weaker our infantry position is, and the less observation is possible from the front line, the more important becomes the watch kept by artillery observation; the latter must be able to view the whole area of close fighting. Where this can not be effected by frontal observation, it will have to be supplemented by observation from a flank. The moment the infantry retires on the artillery observing stations, observation usually ceases.

129. The general demand that, as a matter of principle, the observing stations should be near the battery positions in order to maintain proper communication must be considerably modified under conditions which actually obtain. In no circumstances must a battery commander be satisfied with a battle station from which little or nothing can be seen. On the other hand, artillery group commanders must generally be content with poorer possibilities of observation, especially if their fighting sector is wide. They must, however, always seek to insure their influence on the battle by controlling the observation. A concentration of observing stations at any one point must be avoided in all circumstances.

130. The laying of telephone lines which are most exposed to destruction by the enemy's fire must be carried out according to an exact plan. The avoidance of localities and areas that

are kept under heavy fire is not usually sufficiently taken into account. This is often due to the fact that officers with technical knowledge are not everywhere entrusted with the supervision of telephone communications. These officers, with their subordinates, should be kept as long as possible at such duty.

Large numbers of wires are often run along the same route, with the result that they mutually affect each other. Lines no longer required must be removed altogether and as soon as possible.

131. Communication between infantry and artillery is especially important. It must be the aim of both arms to effect and maintain the closest mutual cooperation. The continual exchange of all observations about the enemy by means of telepone conversations, liaison officers and personal conferences at battle headquarters is necessary. Every man in the infantry must be made to understand that his observations regarding both the enemy and the fall and effect of our own fire provide the artillery with most valuable supplementary information for fire control. On the other hand, caution is necessary when the infantry express an opinion as to the fall of our shell, as it is a matter of experience that they very often mistake our own and the enemy's fire, with the result that a battery that is shooting well is taken off the target by faulty correction.

132. Changes in the distribution of sectors should only be made if there are urgent reasons for it. Making the artillery fit in with such changes causes far more friction and upsets matters far more than it does in the case of infantry, and may in some circumstances interrupt or endanger effective fire at the right moment.

(g) FIRE ACTIVITY.

133. In addition to the ammunition allotment, counterbattery work is to a large degree dependent on possibilities of observation. It is, therefore, the special duty of all artillery commanders to keep the preliminary arrangements for bombarding the enemy's artillery up to date, so that effective shoots can start as soon as observation becomes good. Continual active cooperation with artillery aeroplanes, balloons, and survey sections is therefore necessary.

134. Weather conditions will often make the employment of the very heavy flat-trajectory guns against distant targets a difficult matter. We have, however, learned from experience that the fire effect of these guns can not be made full use of

when shooting from the map. In spite of most carefully taking into account all the influences which are foreseen in the regulations for arranging such shoots, there are generally such large errors that unobserved shoots are a complete failure. It does not, therefore, seem justifiable to use these guns for shooting from the map, when their short length of life and their expensive ammunition are taken into consideration. During battle, however, it must be possible to employ the fire of these guns against targets close in front of our own line. Their fire should then be directed mainly on villages, and this must be prepared for by the arrangement of the requisite observing stations on the ground.

135. The field artillery, especially with its light field howitzers, can relieve the heavy artillery of some of the counterbattery work, and should in the main be employed against hostile batteries that have only recently occupied their positions, and are, therefore, in all probability, provided with less cover. The former must become accustomed to the fact that all the special means of reconnaissance and observation, such as balloons and aeroplanes, are at their disposal just as much as at that of the heavy artillery and must be made full use of. The necessary communications must be provided from the outset and must be maintained.

136. For the purpose of destructive fire, the most careful observation of the situation and state of construction of the enemy's front and rear lines is necessary. Every change in the enemy's positions, recognized from an infantry report or from a balloon or photographic reconnaissance, will cause an alteration in the basis for destructive fire. The divisional commander, who bears all responsibility for his sector, and under whose command the whole artillery in the sector is placed, must therefore daily issue orders to the artillery commander as to the targets for destructive fire and the ammunition to be used against them by the artillery. For this purpose it will generally be necessary for the divisional commander to issue daily two artillery orders (morning or evening) in writing.

Should the conditions change during the course of any day, it will be possible to switch the fire over quickly, as the command posts of the divisional commander and the artillery commander are close together.

137. The best picture of targets for annihilating fire will be obtained if one puts one's self in the place of the enemy before

his attack, and paints in on the map the probable formations which the enemy would adopt before the attack on account of the peculiarity of the ground and the situation of the enemy's trenches. From this it will be at once seen that annihilating fire must not be rigid, but must be flexible, as it must conform to all changes in the enemy's position, especially such changes as imply preparations for an offensive.

138. As annihilating fire must be used not only before an assault, but also during an assault, at which time the field batteries are employed for delivering barrage fire, it will be advisable to distribute the heavy artillery fire over the most important points in the enemy's trenches; these trenches will thus be kept under fire when the field artillery passes from annihilating to barrage fire. For example, it is wrong, during annihilating fire, only to bombard the enemy's front line trenches with field artillery, for then these trenches would not be fired at at all as soon as the field artillery passes to barrage fire, and therefore drops its fire close in front of our own front line. This front line trench is, however, naturally the starting point for the assault and also for the enemy's rear assaulting waves, which up to this point can still make use of their communication trenches.

139. Annihilating and barrage fire must always be registered and the registration checked. Just as in the case of barrage fire, preparations must be made to concentrate annihilating fire in front of certain sectors, especially in those parts of the front where signs of any intended attack are increasing. Exact maps must also be kept for annihilating fire. It will be best opened on the receipt of short code words, each sector being allotted its own code word.

140. The use of light signals to call for the opening of barrage fire has proved the best method, as compared with sound signals which either entirely failed, or, at any rate, made it impossible to recognize with sufficient certainty the sector which was calling for fire. The wish for a more frequent change of light signals is always recurring and is quite justified, as the few signals so far provided make it easy for the enemy to imitate them and thus inveigle us into opening barrage fire with its heavy expenditure of ammunition.

It is, therefore, advisable to order the artillery not to comply with the light signal for "lengthen the range" during barrage fire, in order to stop any attempts at deception by the enemy.

Compliance with such a signal sent up by the enemy may make our whole barrage ineffective and lead to the success of the enemy's attack.

141. In addition to light signals, which are often useless in a fog, all other means (horn signals, klaxons, sirens, trench wireless sets) must be employed for calling for barrage fire.

142. A special light signal has recently been introduced in the army to call for the opening of annihilating fire. This will only be sent up from the battle headquarters of battalions in front line, and then only if the telephone breaks down.

143. The selection of a "directing barrage battery," the communications to which from the front and from other units of the artillery must be especially carefully constructed, has proved of value. This battery must be known to all other batteries in the divisional sector, and as soon as it opens barrage or annihilating fire, all other batteries must at once open barrage fire, that is, if barrage or annihilating fire has not already been called for by some other means. Inquiries must, however, at once be made as to whether the directing barrage battery is delivering annihilating fire; if so, the other batteries will at once change to this method of fire.

144. Battery commanders must make every effort to pass as soon as possible to observed fire from annihilating or barrage fire which has been automatically opened, and is thus at first not being observed. This is the best means of insuring that an enemy, who has broken through, comes under our fire during his further advance. It is the special duty of the senior artillery commanders to make the young battery commanders proficient in such duties by means of instructional schemes, which should be discussed on the ground.

145. The field artillery must take an active part in destructive fire. For this purpose, it will be advisable to employ certain batteries which, on account of their positions being as far forward as possible, are able to make full use of their maximum range.

The view that the enemy's organizations should only be bombarded if he annoys us in the same way (retaliation fire) is wrong and must be combated emphatically. This applies especially to the rearward works and billets, where considerable damage can be done to the enemy. In this sphere also the initiative must not be left to him.

(h) ATTACKS AND COUNTERATTACKS.

146. To prepare for attacks and counterattacks, the artillery must always be given sufficient time for reconnaissance, registration and fire for effect. Breaches of this rule lead to self-deception and reverses. It is the duty of artillery commanders to see that this is taken into consideration. It follows from the above that shortly before or after daybreak is an unsuitable time for an assault. Artillery night firing can never be described as real fire for effect. It is only a more or less heavy harassing fire according to the number and caliber of batteries employed and the amount of ammunition expended.

An unsuccessful attack means greater sacrifice than keeping the assaulting troops for a longer period in the assembly position.

147. In a methodical attack, registration must be carried out as unobstrusively as possible and should be distributed over several days, so that on the actual day of attack it will only be necessary to check registration. In order to deceive the enemy, it will be advisable to carry out simultaneous registration against other positions some distance away.

148. In an assault the artillery should not lift its fire off the objective until the moment the infantry enters the enemy's line, and this must be carried out exactly according to the scheduled time; fire must not lift the moment the assaulting infantry goes over the parapet, otherwise the enemy generally finds time to man his trenches. A certain amount of danger to our own infantry, which can be diminished by the use of shells with delay action fuzes shortly before the assault, must be put up with. Similarly, the lifts of the artillery fire during an assault must not be too large. The fire should be immediately in front of the advancing infantry. This needs very careful arrangement.

(i) CLOSE DEFENSE.

149. The battery positions must be provided with obstacles; the guns must be able to fire at once at case-shot distance; to do this they must be able to be pulled quickly out of their pits; hand grenades must be placed in readiness and the gun detachments must be trained for defense at close quarters. An ample supply of small-arms ammunition must be dumped in the batteries in order to be able to supply retiring infantry with ammunition, and thus make it more easy to hold these strong points

until the counterattack is launched. In advanced positions an allotment of machine guns is desirable; the field artillery must know how to use them.

(k) AMMUNITION AND MATERIAL.

150. The ammunition supply within groups (corps) and divisions must be under central control; a special officer is necessary for this duty, who must remain permanently in the area. This must be taken into consideration when staffs are being completed; detailing an officer for this duty from one of the units permanently weakens the latter to an inadmissible extent. The same holds good as regards material. Whether one and the same officer can simultaneously control ammunition and material will depend on circumstances.

151. Ammunition and material must frequently be inspected in the battery positions. For this purpose artificers and armorers should frequently be sent to the positions. In addition, commanders (including regimental commanders) must also occasionally carry out inspections as to the treatment of ammunition and material, in addition to their inspections of battery routine, by means of personal visits to the battery positions.

152. For ammunition supply, small ammunition depots on roads not very far behind the battery positions have proved useful. It is a matter of the most urgent importance to keep the roads of approach in good condition, and to have an active body of road police, especially in villages and at cross roads.

153. It is worthy of remark that our enemy's guns apparently have a much smaller zone of dispersion than our own. He also appears to have better and more accurate data for shooting from the map than we have. This seems to be proved by the fact that in weather that excludes all possibility of observation, and under conditions very different from those prevailing during previous shoots, he obtains hits on small targets with great accuracy.

G. COMMUNICATIONS AND AIR RECONNAISSANCE.

I. Causes of initial failures.

154. The breakdown of the communication service at the beginning of the battle is chiefly attributable to the inadequate provision of means of communication. These were numerically much inferior to those of the enemy. Their increase did not

keep pace with the increase in the number of divisions and heavy artillery units engaged.

155. Further, there was at the outset no organization which could make preparations for the ever-increasing engagement of new formations. It was impossible to control the new formations from army headquarters and there was no organization for this purpose at corps headquarters. The organization had first to be created, instead of the newly allotted communication troops being able to fit themselves into an existing organization. A further difficulty was caused by the individual communication units being allotted, one by one, so that the organization was merely patchwork at first.

156. On the 22d June the following flights were available, viz, 3 artillery, 5 reconnaissance, 13 battle plane, and 2 pursuit flights. These weak forces were unable to play any part against the enemy, who was able to prevent long distance reconnaissances entirely, and almost completely stop our artillery observation and photographic work. The situation demanded that groups (corps) should have been allotted, on a scale corresponding to their frontage, number of divisions, and strength in artillery, a number of artillery and reconnaissance flights together with the necessary number of the battle-plane flights. For this, however, the numbers available were insufficient. Several divisions had to manage with one artillery flight between them, and, at the less important points in the line, this flight was not protected by battle planes, as army headquarters were obliged to employ these at the most threatened points in order to be able, there at least, to obtain information.

157. As regards balloon detachments, the army had at its disposal two detachments with a total of five balloons, as against 25 to 30 possessed by the enemy. Inadequate antiaircrafts gun protection hampered their work. It was impossible to make use of balloon observation from neighboring sectors, as the necessary telephone system was lacking and each balloon was already unable to cope with its own work. The result of this complete inferiority in aerial observation was that our artillery was fighting blindfold. No machines were available for the purpose of communication with the front line, nor were either the troops or the aeroplanes and balloons prepared for this, as the army was not yet familiar with the lessons learned at Verdun.

158. The establishment of telephone stores normally allotted to corps and divisions was not nearly sufficient, and there were

but few additional motor lorry sections available. The army telephone detachment was only formed at the same time as the first army itself. It was quite impossible, simultaneously and as rapidly as desirable, to meet all the requirements due to the movements of numerous headquarters, as well as to the necessity for new lines for the artillery, aviation, A.A. gun, and balloon systems.

The leading and fighting suffered, and it was quite impossible to make full use of even the small available number of aviation, A.A. gun and balloon units. Owing to the defective organization, the experience and knowledge of the telephone system was lost when the corps and divisions changed so rapidly.

159. Field signal sections, power buzzer stations, wireless detachments, and carrier pigeon lofts, which were necessary to supplement the telephone system in the main fire zone, were almost entirely lacking, with the exception of the signal sections with the divisions and a few pigeon lofts. The small number of pigeons was insufficient, as "infantry aeroplanes" were not yet available, and runners and light signals were the only means left for communication with the front line. It was unavoidable that, after heavy attacks, the position of the front line should often be unknown to commanders and to the artillery for a considerable time.

160. The survey section was also only formed at the same time as the first army, and was consequently deficient in most respects at first. New surveys had to be undertaken, as our own line had in places almost reached the eastern limit of the mapped area. Owing to the inferiority of our aviators, air photographs did not furnish, as quickly as was desirable, the data on which to decide which battery positions and trenches were still used by the enemy. Our artillery was much handicapped on this account.

II. Measures by which a gradual improvement was attained.

INCREASE OF THE MEANS OF COMMUNICATION.

161. An improvement in these conditions was at once effected, as soon as the means of communication had been increased to such an extent that they met the most urgent requirements. This increase must be considered as a decisive factor in the whole course of the battle. Only of secondary importance were the measures which aimed at securing uniformity of control over the means of reconnaissance, and the cooperation of all other

means of communication, as well as insuring that the experience gained would be available even if there were changes in command.

162. The whole of the aircraft was employed with a view to providing observation for artillery and obtaining aeroplane photographs. All the special duties of the battle plane were subordinated to this.

The employment of aeroplanes with a view to obtaining a complete mosaic of aeroplane photographs, and the collection of information gained by air reconnaissance, were handed over to the aeroplane group (wing) commanders at corps headquarters. The cooperation of these commanders with the general staff officer for intelligence insured coordination of aerial and ground reconnaissance.

As soon as sufficient artillery flights were available they were allotted, together with protective flights, to the divisional artillery commanders.

After infantry aeroplanes had been introduced by orders of army headquarters on special occasions in the first few weeks of the battle, an infantry flight was detailed for each group as soon as the number of reconnaissance flights had been increased.

163. The balloon detachments were connected, by means of a telephone system of their own, with each other and with a newly formed balloon central station. The latter collected the results of reconnaissances with a view to their being collated by the survey section, and disseminated all the observations made. This enabled every battery to fire with observation from the particular balloon which was best able to observe the target.

164. The telephone system was improved by the allotment of permanent units (communication officers, traffic and construction sections). This prevented the experience gained and knowledge of the system from being lost.

The grouping of the various means of communication in "headquarters communication sections" under a responsible commander insured a better system of tactical cooperation and mutual assistance.

165. The wireless detachments proved their value. It was found necessary to control the wireless traffic within groups. For this purpose group wireless officers were appointed who controlled the whole of the wireless traffic, including aeroplane wireless. Arrangements were made to use wireless for calling for barrage, by employing aeroplane receiving stations (ground stations) for the purpose.

166. The field signal sections, when they were not on the establishment of the subordinate formations but were army troops, were relieved from time to time in order to maintain their efficiency. The small number of sections available in the army necessitated their being relieved by sections from other armies.

167. The number of carrier pigeon lofts was increased.

168. In order to increase its usefulness, the survey section was reinforced by a special detachment under the staff officer for survey of the fifth army. Entirely new mapping material was obtained. All results of reconnaissances were centralized, firstly at group headquarters and secondly at army headquarters, which insured that full use was made of all information. The extent of this information and the necessity for passing it rapidly to the troops led to the formation or expansion of the topographical sections with each group (corps). These sections had also to keep the maps of our own positions up to date and were made responsible for all information regarding a definite area in their front.

III. Experiences and lessons.

(a) EMPLOYMENT.

169. The defensive battle necessitates the employment, on a very large scale, of means of communication and reconnaissance, which should be proportionate to the number of divisions and the quantity of heavy artillery engaged. Whereas a newly engaged division is at once effective, communication units require a certain amount of time in which to settle down before they can develop their full powers. Consequently they should be engaged as early as possible, and from the outset on a scale which is based on the number of troops which will be engaged later on.

170. The following proportion, which was found sufficient on the Somme, may be taken as a basis on which to allot artillery and reconnaissance flights, viz., one artillery flight with a protective flight for each division, one infantry flight for every group (corps), and two or three reconnaissance flights, including one for photographic reconnaissance, for every group of three or four divisions. Whether this allotment will suffice in the next defensive battle will depend mainly on whether the number and efficiency of our pursuit flights will suffice to establish superiority in aerial fighting.

171. Early engagement is also necessary for the balloon detachments if the observers are to obtain good results early. At the same time, sufficient antiaircraft protection must be

provided. The number of balloons should amount to about two per division (they need not be placed under the orders of the divisions). A portion can be detailed as infantry balloons. Other troops must keep clear of the anchorages of kite balloons.

172. When the reorganization has been completed the telephone units will suffice, as far as can be seen, for the needs of corps and divisions. A special allotment of these units will, however, be necessary in order to construct the extensive artillery, aviation, antiaircraft, and balloon systems which become necessary at the beginning of the battle. It is absolutely necessary to keep these systems separate from the tactical lines and from the general telephone system. The sooner they are ready, the sooner will the weapon concerned be effective. Every economy, especially at the beginning of a battle, decreases the effectiveness of other branches of the service.

When engaging telephone units it must be borne in mind that the maintenance of the lines in the main fire zone can not be expected; but, on the other hand, the importance of this means of communication demands that everything possible should be done to repair, at least, the most important lines. With this in view the number of lines close up to the fighting line should be strictly limited. They should be laid in special deep cable trenches, or, at any rate, in shallow trenches to protect them against the blast of the explosion of the enemy's shells. Numerous cable repair squads should be quartered in shell-proof dugouts along the whole line. Roads and villages should be avoided. The enemy's artillery fire should be continually watched, so that heavily shelled areas may be avoided when constructing new lines; existing lines should be removed from these areas as soon as possible, as it will be impossible to keep them in repair.

In the main fire zone the telephone must be supplemented by other means of communication.

173. Shell-proof dugouts are essential for wireless stations; when these are provided, wireless proves very useful. As the number of sets available is limited the forward stations should be placed near the front line, close to battle headquarters (battalion commanders), which have as extended a view as possible over our own and the enemy's front, so that they will be able to give information regarding neighboring sectors. The fear of losing a forward station should in no circumstances act as an inducement to withdraw it prematurely or to place it in a retired position from the outset. The whole object of

wireless stations would thus be defeated. Forward artillery observers can also employ wireless stations with advantage. Owing to the small number of stations available it will generally be advisable to allot several forward stations to one back station. It is most desirable to employ the aeroplane fighting stations with a view to using their wireless for ground communication. The employment of wireless and aeroplane wireless stations for regulating barrage fire is now being experimented with. It is for consideration whether each field artillery *Abteilung* should not be equipped with a receiving set, to be manned exclusively by the artillery, for the receipt of calls for barrage fire.

174. Power buzzer stations have proved their value. In order to prevent their disturbing the telephone traffic, telephone earths should be placed as far away from them as possible (at least 165 yards).

175. Field signal sections, as well as the medium and small signaling apparatus, have proved their value. All light-signaling communication necessitates an accurate study of the map and the ground, so that rearward communication may be established in cases of necessity by means of the neighboring sectors when direct communication is no longer possible.

176. Carrier-pigeon lofts are required in large numbers. Every division should have its own loft. As it is often impossible to avoid moving divisional headquarters it seems advisable not to place the lofts at divisional headquarters, so as to obviate the difficulty of not being able to use the pigeons when headquarters are moved, but they should be kept farther in rear at points provided with direct telephone connection. In order to get the pigeons forward energetic subordinate commanders are necessary in certain circumstances.

177. Hitherto runners have proved the most reliable means of communication in the foremost line.

In order to reduce casualties among the runners it is necessary to introduce a special bullet to carry the messages and to be fired from a rifle or light pistol with a view to connecting the front line with the company commanders and the latter with their battalion commander.

178. The employment of infantry aeroplanes and infantry balloons has proved very valuable. The infantry aeroplane will, in many cases, bring the quickest and best information regarding the situation of the front line. Communication be-

tween battle headquarters and aeroplanes by means of light signals is extremely difficult. It is better to send predetermined signals by displaying various arrangements of the linen signals at battle headquarters.

Signaling communication with infantry balloons requires thorough practice.

(b) ORGANIZATION.

179. Now that means of communication are employed on such a large scale in a defensive battle it is no longer possible to control them from army headquarters. Consequently the necessary officers for this control must be appointed at corps headquarters.

180. The command of the aviation units of each group must be handed over to an "aviation group commander," who will arrange for their employment in accordance with orders from corps headquarters, will collect the information obtained, and will see that this is supplemented by information obtained by other means of reconnaissance. Artillery flights are under the artillery commanders, infantry aeroplanes under the divisions, and all other aviation units under the corps, unless they are retained at the disposal of army headquarters.

181. Balloon detachments are under corps, who allot them to the various artillery groups. In this manner the observations made in neighboring sectors will be better utilized than if these detachments were under the divisions. A balloon central station has been formed for the whole army area. It disseminates the information to all groups, collects the results of reconnaissances, and is responsible for disseminating them. It can also take over the supply of material. Infantry balloons are under corps or divisional headquarters, depending on their employment.

182. The other means of communication are, for tactical purposes, grouped together in "headquarters communication sections." which facilitates their proper employment and cooperation.

Whereas flights and balloon sections, as army troops, are stationed permanently in certain areas, a portion of the other communication units change with their divisions.

183. For those units which belong to groups (corps) a special organization appears to be necessary. The existence of many small units which are distributed throughout the whole army militates against their being rapidly engaged on the main battle fronts. Small units are not desirable, either from an

administrative or a training point of view, and during a long-drawn-out battle they can not effect the necessary reliefs. In the next battle the troops and commanders will make still greater demands on cable communications, and a still greater expenditure of ammunition by the enemy, with a corresponding destruction of the communications in the front battle zone, must be expected. It appears essential to have large reserves of communication troops available (telephone, wireless, field signal sections, power buzzer stations, carrier pigeons, and messenger dogs). It will be advisable to form communication units which comprise all these means of communication in various detachments. The formation of these reserves under general headquarters would enable as many communication units as were necessary to be engaged at once at the beginning of a trench battle. The gradual withdrawal of many small isolated units from other fronts, which so easily leads to their being engaged "drop by drop," would be obviated. The formations would be accustomed to working together and would be able to effect the requisite reliefs within themselves, the necessity for which has been so clearly shown. On the other hand, the majority of these means of communication can be dispensed with on quiet sectors of the front where telephone communication is maintained.

184. As regards organization after the units have been engaged the following points have been brought out:

The changes in the telephone units of corps and divisions lead to the experience and the absolutely necessary knowledge of the telephone system being lost. Consequently, a permanent communication officer is necessary for each corps and divisional sector during the whole period of the battle. The telephone squads which are necessary for the construction of the special artillery, antiaircraft, and aviation systems must remain with corps throughout the whole battle as permanent traffic and construction personnel. This will obviate the otherwise unavoidable friction, with all its disadvantages to the conduct of the battle. It will be the duty of the communication officer to keep up maps showing which portions of the battle zone are heavily shelled or otherwise (communication maps). Many casualties can be avoided by these means.

185. The wireless units are tactically under the division; their technical control, however, must, in view of the jamming within the group, which would otherwise be unavoidable owing to the narrow fronts of the sectors, be exercised by the wireless

commander at corps headquarters. The allotment of wave lengths to aeroplanes is also included in this officer's duties. The organization of the wireless detachment must be such that there is a reserve station, with personnel, available in case of breakdowns, or for employment with the forward artillery observers. In addition, some detachments should, if possible, be kept in reserve to act as reliefs.

186. The field signal sections and power buzzer stations are entirely under the control of the headquarters communication section. Here, too, organization in fairly large units is desirable, so as to make reliefs possible.

187. Mobile carrier-pigeon lofts should be filled up with fresh young birds whenever they are moved to a different point, as the latter accustom themselves to the new place in a comparatively short time.

188. The means of communication of the troops in line (telephones, signal apparatus) must remain entirely at their disposal.

189. The survey section, owing to the wide extent of the battle, is no longer in the position to sift all the information sufficiently quickly and disseminate it to the troops in the form of a map. It is essential that each corps headquarters should establish a topographical section, which will undertake the sifting of the information received and print maps for a particular sector both in front of and behind the front of the group. The topographical sections must be provided with skilled staffs and plenty of materials.

190. When fresh army or corps headquarters are established the employment of newly formed telephone detachments, survey sections, etc., must, in principle, be avoided. It takes weeks for the units in question to become fully efficient, a circumstance which is perhaps unobjectionable on a quiet front, but which may have very serious disadvantages on a principal battle front. It seems better to withdraw existing formations from quiet fronts and to send the new formations to replace them.

(c) PREPARATIONS ON QUIET FRONTS.

191. A special aviation telephone system should be prepared, sufficient for the conditions of a great defensive battle. The infantry aeroplanes should practice frequently with the infantry.

192. The balloons should practice signaling with the infantry. A large number of balloon observers from the other arms should

be trained, so that if new detachments are brought up the necessary number of observers who already know the ground is immediately available.

193. The system of telephone wires should be relaid, avoiding roads and villages as far as possible, so that telephone lines for use in battle lie entirely outside villages, while several lines run to the most important points by different routes. Preparations should be made to enable communications to be quickly established in case fresh divisions are put into the line or the existing divisional headquarters are moved. (Construction and alteration of local communications.)

194. The construction of dug-outs for a large number of power buzzer and wireless stations and field signal sections; these should be provided in the rearward positions as well. The establishment of a large number of light-signal lines.

195. The ground to the depth of about 30 miles behind the front should be surveyed. Topographical sections should be established. The personnel should be dispatched to the survey sections of the principal battle fronts to learn the new requirements which have arisen (e. g., maps in which the enemy's artillery positions are numbered consecutively become useless at once if the enemy brings up a large number of new batteries, as it then becomes impossible to find any battery number. They should be designated by letters within the map squares. Our own trenches and those of the enemy should be numbered.)

H. THE FIGHTING TASKS OF AEROPLANES AND ANTIAIRCRAFT ARTILLERY.

I. Causes of initial failures.

196. The beginning and the first week of the Somme Battle were marked by a complete inferiority of our own air forces.

The enemy's aeroplanes enjoyed complete freedom in carrying out distant reconnaissance. With the aid of aeroplane observation the hostile artillery neutralized our guns and was able to range with the most extreme accuracy on the trenches occupied by our infantry; the required data for this were provided by undisturbed trench reconnaissance and photography.

By means of bombing and machine-gun attacks from a low height against infantry, battery positions, and marching columns the enemy's aircraft inspired our troops with a feeling of defenselessness against the enemy's mastery of the air.

On the other hand, our own aeroplanes only succeeded, in quite exceptional cases, in breaking through the hostile patrol

barrage and carrying out distant reconnaissances; our artillery machines were driven off whenever they attempted to carry out registration for their own batteries. Photographic reconnaissance could not fulfill the demands made upon it.

197. Thus at decisive moments the infantry frequently lacked the support of the German artillery either in counterbattery work or in barrage on the enemy's infantry massing for attack. Heavy losses in personnel and material were inflicted on our artillery by the enemy's guns, assisted by excellent air observation, without our being able to have recourse to the same methods. Besides this, both arms were exposed to attacks from the air by the enemy's battle planes, the moral effect of which could not be ignored.

198. The causes of this inferiority on the part of our own aeroplanes lay, firstly, in their numerical inferiority, which, at the beginning of the battle, was in the proportion of 1 to 10. We were also insufficiently supported by our antiaircraft guns, the small number of which had been reduced still further both by numerous casualties to equipment caused by the hostile artillery and by the wearing out of the guns themselves. An adequate antiaircrift telephonic system was also lacking, so that the reports about the appearance of hostile aeroplanes mostly arrived too late. The fact that our battle-plane squadrons were stationed far in rear of the front made it difficult for them to arrive in time, and the fact that the First Battle-plane Squadron was equipped with "G" machines made its employment for air fighting almost impossible.

II. Measures by which a gradual improvement was attained.

199. The reenforcement of the air forces which was gradually effected, and especially the arrival of powerful pursuit machines, was principally responsible for the improvement of the position in the course of the battle.

200. A well-organized grouping of the available aircraft on the most threatened sectors of the front, as well as our own counterattacks, enabled us to obtain a local superiority in the air, at any rate at decisive moments. The distribution of aircraft units to groups (corps) insured their suitable employment on the days of ordinary fighting.

201. The organization of defensive patrol barrages, which only lead to a dispersion of strength, was forbidden.

On the other hand, it was made the duty of every flying officer to attack the enemy's machines over the enemy's lines in order

to facilitate the work of reconnaissance and registration. Strong fighting patrols of at least three machines were employed to carry out this task.

202. As soon as sufficient aircraft units were available, bombing and machine-gun attacks on the enemy's infantry and battery positions were undertaken.

203. The aircraft units in rear were brought up as close to the front as the choice of aerodromes and the range of the enemy's guns allowed. By this means it was insured that they were always well informed about the situation on the front and could arrive rapidly on the spot whenever a number of hostile machines appeared. With the same object, during the days of heavy fighting, aeroplane liaison officers were sent to divisional command posts or observing stations.

204. Owing to the extension of the front and the activity of the enemy's machines, it became impossible to control the struggle for air superiority from one office at army headquarters. Each group (corps) was therefore allotted a wing commander (*flieger-gruppenführer*) corresponding to the allotment of aircraft units to the groups. This officer controlled the employment of the available forces, more especially as regards air fighting.

205. The battle-plane squadrons were split up as protective flights (*Schutzstaffeln*) and allotted to the various artillery flights, their aerodromes being changed at the same time so as to insure close cooperation between the fighting and reconnaissance units.

206. Cooperation with antiaircraft guns, especially as regards utilizing their observations of the enemy's aerial activity, was insured by the organization of joint antiaircraft report centers and of a single aircraft and antiaircraft telephone system. Reports concerning the situation on the front and the demands of the troops for antiaircraft protection were collected by these officers of the antiaircraft service stationed close to the front. The information was passed on by them to the wing commanders of pursuit flights attached to army headquarters, who in turn could regulate the employment of their units accordingly.

III. Experiences and lessons.

207. In trench warfare to obtain the mastery of the air during a battle is an essential condition for long-distance and trench reconnaissances as well as for artillery registration. Next to the strength of the artillery and the quantity of ammunition

available the mastery of the air forms the decisive factor for success in the artillery combat. The struggle for supremacy in the air must therefore precede the artillery battle.

Only the early employment of strong air forces is here productive of success. These must be supported by a numerous antiaircraft artillery and the efficient working of a well-organized telephone system.

The attacker will, by the employment of strong air forces, be able to acquire the mastery of the air from the outset, but at the same time will betray his offensive plan. As soon as the first preparations for hostile attack are recognized it will be the task of the defender to concentrate rapidly all the air forces which can be spared from quiet sectors of the front, and particularly numerous strong pursuit flights, with a view to depriving the enemy of the mastery of the air. If he is successful, at all events, in hindering the enemy considerably in his reconnaissances and in disturbing his artillery registration to a certain extent, he may then in certain circumstances delay the attack considerably and gain sufficient time to complete his other defensive measures. The sooner he can employ strong aerial forces the better will be his chances of success.

208. The main object of fighting in the air is to enable our artillery registration and photographic reconnaissance to be carried out, and at the same time to prevent that of the enemy. All other tasks, such as bombing raids, machine-gun attacks on troops, and even distance reconnaissance in trench warfare, must be secondary to this main object. So long as the execution of the main task is not insured, all available forces must be employed for this purpose. All subsidiary tasks must be abandoned even when the enemy's attacks in the air are causing us considerable annoyance.

209. So long as our air forces are insufficient to attain a superiority of this nature upon the whole front endeavors must be made to obtain superiority at least at the decisive points, either during the preparation of an attack by ourselves or by the enemy. For this purpose the aerial forces must be concentrated at the right time and the right place, which is best effected by orders from army headquarters. In other respects the available aircraft units should be allotted to corps headquarters, where their employment during the operations will be controlled by the wing commander in accordance with corps orders. On days of ordinary fighting, the most effective employment of all units will be best obtained on these lines.

210. The employment of numerous single-seater fighting machines is the best method of destroying the enemy's aircraft. These units are most suitable for offensive work. Their task is to attack and destroy every hostile machine which shows itself. Whether the enemy's machines fall into our hands or not after they have been shot down is immaterial in estimating results. The shooting down of machines beyond the enemy's lines bears equally good testimony to our superiority in the air.

The number of pursuit flights engaged should be sufficient to gain the mastery in the air from the enemy. Their number is not the only decisive factor, but also their success in action. During the Somme Battle the First Army had attached to it the Second Pursuit Flight, which now bears the name of its heroic commander, Capt. Boelcke, who unfortunately perished too soon. This pursuit flight shot down 87 machines during the Somme Battle, 21 of these having been brought down and crashed by the commander alone.

211. In order to carry out their tasks the pursuit flights must be allowed the greatest latitude in their employment. A primary condition is, however, that they are stationed so close to the front that they can at once act on their own observations. There is no truth in the widely spread idea that, owing to the speed of the machines, the billeting of the unit several kilometers farther back is of no importance, for reports of the appearance of hostile aeroplanes arrive too late at positions in rear, and a constant patrol barrage with the object of always being on the spot involves an unnecessary expenditure of force.

212. Artillery machines are prevented by their functions from paying sufficient attention to hostile aircraft. Therefore, in addition to the presence of single-seater battle planes, they require special protection by escort machines belonging to protective flights. In order to obtain perfect cooperation it is indispensable that their protective flights should be housed in the same aerodrome.

213. The machines detailed for photographic or distant reconnaissance during a battle are no longer able to carry out their tasks alone; strong patrols of at least three machines should be employed on principle.

214. Attacks on kite balloons are only seldom successful in consequence of the effective protective measures adopted by the enemy. Such attacks require thorough preparation and sometimes the assistance of artillery in order to neutralize the enemy's antiaircraft guns. In offensive operations they may

be carried out with advantage shortly before an assault in order to divert the attention of the enemy's artillery.

215. Bombing attacks by single machines have only a small chance of producing results, even when by frequent repetition they succeed in making an impression on the enemy's *morale.* These attacks are, therefore, only worth while when they are carried out during the course of other duties and not as a sole objective.

Bombing attacks by whole squadrons against previously selected targets may produce most successful results, especially at night, when the enemy's countermeasures are less effective. The best targets are large camps and ammunition depots known to be occupied, as well as railway stations.

216. Machine-gun attacks on troops, when carried out frequently, undoubtedly produce great moral effect, especially when the troops have been previously shaken by a severe artillery bombardment. This form of attack can not, however, cause the enemy any considerable casualties.

In any case, the employment of machines for these subsidiary tasks can only be justified when the main objective has been obtained; that is, to enable artillery observation to be carried out.

217. All operations of battle planes must be supported by numerous antiaircraft guns in order to hinder the enemy's reconnaissance and artillery observation.

The employment of antiaircraft units is best organized by arranging a forward line of antiaircraft guns, the individual positions being on an average not more than 2,200 yards apart. Any gaps in the front line should be closed by a second back line. The defense of important railway junctions, ammunition depots, etc., will also be undertaken by antiaircraft guns in order to set free the battle planes for operations on the front.

218. In order to engage the enemy's artillery machines, which work at a low height close behind the enemy's lines, and are therefore out of reach of our own battle planes, single guns must be pushed forward as close to the front as possible (say, 2,200 yards). These guns must be placed in concealed positions in order not to expose them to premature neutralization. Suitable positions are afforded by large villages, which are easy to get out of, and where the cellars provide cover for the detachments in case of emergency.

219. The machine-gun antiaircraft sections may be used with advantage for the protection of kite balloons. One section should be permanently allotted to each balloon.

220. So long as the antiaircraft guns are stationed within effective range of the enemy's artillery, three alternative positions must be prepared for each gun. In the case of motor antiaircraft guns it is advisable to allot to each gun a small area within which it can change position as required. It is necessary to maintain an adequate supply of ammunition (800 rounds per day) at the positions of the front line of antiaircraft guns.

221. Cooperation with aeroplanes, especially with pursuit flights, must be insured by setting up a special air-defense telephone system, with which all aircraft and antiaircraft units are connected. All reports are sent to a central station in each group, with which the wing commanders and group antiaircraft officers are directly connected. Reports are collected here and forwarded as required to the units concerned.

222. The establishment of joint observing posts for aeroplanes and antiaircraft guns is recommended. The firing of a few direction rounds by antiaircraft guns in order to call the attention of their own aeroplanes to hostile machines has proved very successful.

223. The infantry must always take part in the defense against hostile aeroplanes by means of machine-gun fire. In many cases hostile machines which have caused great annoyance have been successfully shot down by this method.

I. EFFECTS OF GAS AND PROTECTION AGAINST GAS.

EXPERIENCES AND LESSONS.

224. The lack of effect of the great British gas attacks at the end of June, which were delivered as a preparation for the infantry attacks in spite of the unfavorable weather, resulted in our troops beginning to underestimate the effects of the enemy's gas. Later gas attacks on a smaller scale, which the enemy delivered successfully owing to the weather conditions being favorable, caused the same troops losses which were partly due to carelessness.

225. The enemy's employment of gas shells caused a large number of isolated casualties, especially when the enemy combined high explosive shell with gas shell. When gas shells were employed on a large scale by the enemy, the gas was less effective in causing losses than it was in interfering with our action.

Poisonous gases were employed along the whole front; lachrymators, which had but little effect, were only employed by the British.

226. The casualties from gas, apart from the usual number of unavoidable accidents, were for the most part attributable to

the fact that the individual did not sufficiently understand to what dangers he was exposing himself in a gas attack if he waited to put on his mask until the smell of the gas became intolerable, or if he became excited by the fact that the attack was over and took his mask off too soon. Disobedience of the order that in the line gas helmets are always to be carried in the "alert" boxes on the person was another reason for casualties.

227. The methodical instruction of the men in these matters, which is obviously very necessary from what has been said above, is the duty of commanding officers, who must be assisted by efficient antigas officers.

The training and equipment of fresh drafts must be begun at the training depots in Germany, and be emphasized when the recruit joins his unit.

228. Our own gas shells were employed for counterbattery work against hostile batteries which had been located, and, according to prisoner's statements, have often proved effective. In methodical attacks a bombardment with "green-cross" shell of the enemy's observation posts and barrage batteries just before the assault considerably reduced the intensity of his fire.

No experience is yet available of the effect and combining "green-cross" shell with high explosive shell in harassing and annihilating fire.

APPENDIX.

PREPARATORY MEASURES BEFORE THE ENGAGEMENT OF A DIVISION IN A DEFENSIVE BATTLE.

The following preparatory measures, taken by a particularly successful division which was three times put into the Somme Battle, have proved both necessary and suitable:

A. DIVISIONAL STAFF.

Organization of the staff for the increased stress of work which may be expected during the battle, and attached troops. An orderly officer for intelligence, maps, and examination of aeroplane photographs. Office work to be so arranged that the G.S.O. may always be able to obtain personal knowledge of the battle field and the tactical situation. Formation of officers' battery positions. Officers and N.C.O.'s for transport purposes divisional staff officers.

As soon as it is certain that the division is to be engaged, a personal reconnaissance should be made of the position, approaches, existing communications, and distribution of the artillery.

Issue of large scale maps to the troops so that they may be informed beforehand of the situation. Sketches of the individual infantry sectors for advance parties when the relief takes place. Allotment of motor cars to facilitate personal reconnaisance on the part of the infantry sector commanders.

B. TROOPS.

1. INFANTRY.

1. TRAINING—*For the combat.*—Bombing, competitions with live grenades, practice with captured grenades, the best throwers to be formed in bombing squads; the attack of small parties with a view to clearing up lengths of trench from front and flank; training of as many officers and men as possible in machine-gun work; early allotment of reserve material to the machine guns and registration of new machine guns; formation of a machine gun central depot, to which a sergeant artificer is allotted, and which is provided with a reserve of material; later this should be moved forward to the neighborhood of the regimental battle headquarters.

Instruction as to the general situation and as to when it is permissible to call for annihilating and barrage fire; practice with light pistols, signal rockets, and sound signals; arrangements for obtaining intersections on points where barrage fire is required; instruction as to conduct if taken prisoner; inspection and instruction in antigas mueasures.

For the construction of defenses.—Construction of deep dugouts (every man must have put up at least one frame); drainage of trenches; construction of portable entanglements.

The division will arrange for instruction in light signaling (especially 1916 pattern medium signaling apparatus), the employment of carrier pigeons, telephone, and wireless.

Communication between infantry and aeroplanes is to be carried out practically. For this a short code is necessary, which comprises all phrases which are necessary for tactical messages.

2. DISTRIBUTION OF FORCES.—With the increasing specialization in the infantry (light machine guns, light *Minenwerfer*, bombing squads, light signalers, etc.), it is essential for a company commander to detail carefully all his men for duty in the trenches and allot to each man his particular task.

General.—Formation of a fourth platoon as carriers and to act as a reserve; only sturdy, energetic men should be selected for this, and placed under good commanders. Detailing of men as runners and messengers,

3. DISTRIBUTION OF THE PERSONNEL.—Uniform distribution of the young drafts; in every group one experienced soldier, if possible, to support the group commander; detail a reserve of subordinate commanders to the transport; reserve of telephonists.

The following to be detailed to each company: One company commander, one company officer, two acting officers or vice sergeant majors. The remainder as reserve in rest billets or with the recruit depot.

Special duties.—Regimental supply officer for bringing up stores and food supplies (commands carrying parties and arrange for transporting stores to the regimental pioneer park with the regimental baggage wagons).

Superintendent of the regimental pioneer park.—Supervision of engineer stores and demands on the supply officer.

One orderly officer (reserve of company commanders) to each battalion and regimental headquarters.

A second orderly officer in the office (reserve of adjutants); regimental machine-gun officer with the support battalion. Two officers' patrols for infantry brigade headquarters. Officer in charge of trench construction, so that the trenches of the sector may be constructed in a uniform manner by the three battalions.

Regimental observation officer, with a relief.

4. *Equipment and clothing.*—Assault kit; sandbags for carrying hand grenades and iron rations to be carried slung round the neck; fitting of steel helmets; second water bottle; large entrenching tool for every man; working dress (for working parties of the battalions in rear); improvised puttee for use over boot and calf of leg in wet and muddy trenches; protective coverings for breech and muzzle of rifle to be carried; as large a number as possible of food carriers, improvised food carriers, knapsacks to hold food and water; white cloths for signaling to aeroplanes to be carried. For machine-gun units, improvised mountings.

II. CAVALRY.

Training of officers and intelligent noncommissioned officers as observers, with a view to employing them at a divisional observation station. Patrol detachment for every infantry sector, whose task will be—

To gain information regarding the general situation in the front-line trench. Transmission of requests of the infantry in front line. Accurate knowledge of the position of divisional headquarters. Knowledge of the fall of the enemy's fire and of the approaches in the sector which are consequently the most

suitable, so that they will be able to lead up reenforcements during the battle.

Detailing and instruction of men for police duties. Formation of one or more parties for work in connection with the telephone service. Their duties are to ride daily along the lines in the back areas, to put up poles and take measures to prevent breakdowns.

The supervision of the whole question of horsed transport in the divisional sector (the driving of columns and trains to be properly regulated) to be handed over to the squadron commander.

III. ARTILLERY.

Training, inspection, and further training of the gunners (layers). Instruction in barrage fire, error of the day, handling and care of the gun, the various natures of ammunition, care of ammunition. Instruction of observers. Instruction in intrenching, special attention being paid to cover from aeroplanes. Advance officers to be sent forward in good time, if possible, to gain a knowledge of the target sectors and of the battery positions. Officers and N.C.O.'s for transport purposes (communications to the position, ammunition, engineer stores).

IV. "MINENWERFER."

To be detailed in good time into three *Minenwerfer* groups, one group for every infantry sector. Training of the "heavy" and "medium" platoons in the use of the light *Minenwerfer*, as this is the only one which can be used in a long drawn-out battle. Preparatory measures for the supply of ammunition (a difficult matter), formation and allotment of ammunition carrying parties by the divisional staff. Equipment, clothing, and distribution of personnel as in the infantry.

V. PIONEERS.

As in the infantry.

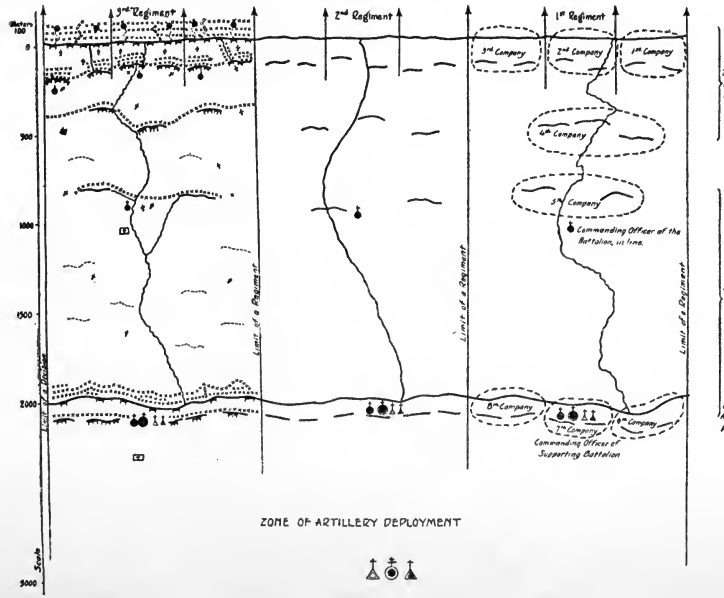
VI. DIVISIONAL TELEPHONE DETACHMENT.

Early reenforcement of the detachment. Training in light signaling, telephone, wireless. Composition of a code for the transmission of the most important tactical messages (this code, which is also used between aeroplanes and infantry, must be issued in good time, and the troops must be perfectly familiar with it).

(Signed) VON BELOW,
General der Infanterie.

SKETCH OF THE ORGANIZATION AND THE DEFENSES OF A DIVISION SECTOR

From A German Document taken in April, 1917



ZONE OF ARTILLERY DEPLOYMENT