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The Field Artillery Journal

Vol. III **OCTOBER-DECEMBER, 1913** **No. 4**

AMMUNITION SUPPLY

FROM LECTURE DELIVERED BY MAJOR H. G. BISHOP, 5TH FIELD ARTILLERY, AT ARMY SERVICE SCHOOLS.

(References are to F. S. R., 1910.)

In all modern armies the ammunition supply may be divided into sections or echelons from front to rear as follows:

1. That with the weapon—which comprises:
   Small Arms—
   - (a) That on the soldier's person, and machine-gun company mules.
   - (b) That on the company or battalion wagons, including the machine-gun supply.

   Artillery—
   - (a) That in the limbers and caisson of the firing battery.
   - (b) That in the battery combat trains.
2. The Ammunition in the Division or Corps Trains.
3. All behind this, whether on wheels or in convenient depots, or both.

All ammunition in the first echelon is ordinarily carried into action or is available for use during action and may be considered as the day's supply for the weapon.

All in the 2d echelon (the division supply trains) will seldom be available except to replenish after the day's fight. It will seldom be possible to get sections of this supply in contact with the combat wagons and caissons in time to refill them and for their return to the firing line during a day's action. or if that is practicable, it will seldom be possible for the refilled combat wagons and caissons to get up to the firing line or turn over fresh supply to the firing line until after nightfall.

The 3d echelon (the fixed or movable bases or sub-bases) is generally

so far in rear that it will not usually be available as a source of supply in the same 24 hours as the combat.

It is ordinarily the 1st and 2d echelons which are of the most concern to the combatant troops, and furthermore, as officers of the line may frequently be assigned to duty with these sub-divisions of the Ammunition Service, and as all officers of the line will at times have to handle them or give them orders, these echelons only will be considered in this paper.

THE FIRST ECHELON.

Taking up the first echelon, the principal questions to be considered are:

1st. Minimum number of rounds sufficient for each weapon for one day's engagement.

2d. Relative number of rounds to be carried immediately with the weapon and number to be carried in the combat wagons and caissons.

3d. Character of the combat wagons and caissons, number of same, equipment and personnel.

SMALL ARMS.

Going back to the minimum number of rounds, how many cartridges per rifle are necessary for a day's fighting?

To determine this, let us see what experience has shown. In studying this phase of the question, it is necessary only to go back to the Franco-German war of 1870-71, the first in which both parties were armed with the breech loader. What is said here as to expenditure in this war is condensed from "Modern European Tactics" by Balck. In this war, the German infantrymen carried eighty rounds per man and twenty were carried in the battalion train.

If we look at the total expenditure of ammunition during a campaign, it would seem as if there never could have been a deficiency of ammunition. In the Franco-German war the expenditure of ammunition in the First Bavarian Army Corps was 166 rounds per rifle; in the Second Bavarian Army Corps it was 44 per rifle; in the Saxon Army Corps, 58 per rifle. These may be taken as representative for this army in this war.

Ammunition Supply.

Necessarily, proper conclusions as to the number of cartridges that must be provided for each infantryman cannot be drawn from the average number fired by any large body of troops, part of whom as reserves fire none at all or very few, compared with those in the first line.

On the 16th of August at the Battle of Mars la Tour, the Third Prussian Army Corps fired only 54.5 rounds per rifle, in spite of which ammunition ran short in places. By taking cartridges from the dead and wounded during the pauses in the firing at noon, the Thirty-fifth Regiment supplied each man with about two hundred rounds, which were nearly all fired away in the course of the afternoon, so that by evening the ammunition again ran out.

One of the most obstinate defensive actions in this war was the defense of the wall of Bazanville (Buzanval) by the Fiftieth Regiment. The enemy was greatly superior in numbers at this point and the quality of his troops was good. The fighting lasted nine hours. Lieutenant-General von Boguslawski says: "It is impossible to say with certainty how much ammunition was expended on this occasion. The second battalion recorded that it had fired fourteen thousand, two hundred and six rounds, nearly all of which was expended by the Sixth and Eighth Companies, as the Fifth Company did not fire a round and the Seventh very few, the Twelfth Company fired an average of ninety-two rounds, or a little more than ten rounds per man per hour."

The French always used more ammunition. At Champigny each French infantryman had one hundred and eighteen rounds, and yet there were not enough. In the French Army of the Rhine, the total expenditure of ammunition during the period from the 6th to the 31st of August was thirty rounds per man, and in the battles of the 16th and 18th of August by corps it was thirteen to twenty-seven rounds per man. Coming down to smaller forces, the figures are much higher. On the 16th of August Grenier's Division, which met the attack of the 38th Brigade, is said to have fired 150 rounds per man. In this war, the French were generally on the defensive and had a longer range rifle, which would account for their firing more shots, and the Germans could not indulge in long-range fire owing to their rifle.

Russo-Turkish War.

In this war both sides had longer range rifles than in the previous one. The Turks, on the defensive, had the longer range gun. For the entire war, the Russian expenditure amounted to thirty-three rounds per rifle and carbine. Coming to smaller units—the Sofia Regiment on the 23d of August fired 94 rounds per rifle; on the 20th of July, in the attack on Plevna, the troops on the firing line in six hours expended 115 rounds each (all they had), and on the 30th of July 60 rounds in four hours.

In the assault on Chernovo the XI Rifle Battalion fired in four hours 120 rounds per man. The XIII Rifle Battalion at Shipka Pass fired 122 rounds per man.

On the Turkish side battalions fired from 100 to 263 rounds per man in one day.

Chilian Civil War.

During the Civil War in Chili (1891) the Congressional troops who were armed with repeating rifles used such an enormous amount of ammunition that the supply contained in their pouches, 180 to 200 per man, was often almost used up in 35 to 40 minutes. At La Placilla 120 rounds per rifle were fired in the course of four hours' fighting, and at Conlon 160 to 200.

Spanish-American War.

No data are at hand as to the expenditure of ammunition. On our own side, the official reports do not give the amount expended on July 1 by organizations, but the following facts were collected:

Cavalry Division; the men went into action with 100 rounds per man and drew no more ammunition until night, when they still had ammunition in their belts.

First Brigade, First Division; the expenditure of ammunition was very moderate, not exceeding 50 rounds per man in any company and in many, much less.

Second Brigade, First Division; average about 65 rounds; certainly did not exceed 100 rounds per man, for they had no more until night.

Third Brigade, First Division; about 20 rounds per man.

Second Brigade, Second Division; in the two regiments engaged, after the fight was over the men had about 50 rounds each, but this includes the ammunition taken from killed and wounded. A few of the men had fired all their cartridges, but they were exceptions

Third Brigade, Second Division; the 7th Infantry expended more than either of the other two regiments, and it had from 10 to 15 rounds per man left at the close of the fight.

General Bates' Independent Brigade; the expenditure was very small, about 10 or 15 rounds per man on the firing line, and the reserve companies none at all.

These reports cover all infantry troops or those acting as such present this day except First Brigade, Second Division. Their expenditure was undoubtedly about the same as in the Third Brigade, Third Division.

These troops were nearly all regulars, disciplined and trained.

The figures as to expenditure of ammunition in the Philippine Insurrection are unknown. They are often extravagantly and even senselessly large. The troops at first were generally raw and untrained, and the conditions in other respects favored an extravagant expenditure.

China Relief Expedition.

In the China Relief Expedition, Captain Brewster reports: the Ninth Infantry at the Battle of Tientsin was in action about thirteen hours. The men went into action with 160 rounds per man and had only about 10 rounds left at the end of the fight.

Considerable ammunition was undoubtedly lost by the men in their advance; the ammunition of the killed and wounded was collected and distributed to the other men.

Boer War.

The British infantryman carried on his person 100 rounds, in battalion small arms ammunition carts, 85 rounds per rifle. Comparatively little accurate information is at hand regarding the expenditure of ammunition in this war.

From the report of the Royal Commission on the War in South

Africa, we find that there were approximately 66,000,000 rounds of small arms ammuntion expended during the war. This includes miantry, cavalry and machine guns. If we accept this figure we have an expenditure of nearly 350 rounds per rifle and carbine. But from this same report we learn that they had 315 machine guns, which would account for a good many of those cartridges. A great many cartridges were lost owing to defective equipment. Lord Kitchener stated in his testimony before the Commission: "Our losses of ammunition in this campaign, which in itself proved a source of supply to the enemy, cannot be ascribed to a want of care of the individual soldier so much as to the peculiar unsuitability of the article supplied to him in which to carry it." The Boer leaders also speak of large quantities of ammunition picked up on the ground where British troops had camped or bivouacked, and of finding them along the line of march. Making deductions for machine guns and losses the number expended per rifle still remains large.

Col. Mayne in the "Infantry Weapon and Its Use in War," says: "No statistics have yet appeared as to the expenditure of rifle ammunition in the various battles in South Africa, but it must have been very considerable, because troops provided with 150 to 200 rounds each had in many cases used them all up before long, apparently without much injury to the enemy, and had to remain for hours on the ground—unable to do anything to assist in the progress of the fight * * * experience alone brought its lesson of thrift in expending ammunition."

Earl Roberts also stated at Bisley in 1901: "In fact, the soldiers do not waste their ammunition under the excitement of battle as was expected they would do, for they rapidly found out that their own safety depended on their ammunition being most carefully husbanded."

On the Boer side we have still less data as to expenditure of small arms ammunition. From the German Official account of this war we learn that the Boer stock of small arms ammunition may be assumed as 80,000,000. How much of this was expended is not stated. They fired much, but figures as to battles are not available. The Boer soldier carried his cartridges in a bandolier containing 60 rounds, and wore two or more of these into action.

Russo-Japanese War.

The Russian infantryman carried on his person 120 rounds, with battalion train 66. The Japanese infantryman carried on his person 150 rounds, with battalion train 59. Complete returns of this war are not available, but some data have been obtained.

Japanese side:—

At the battle of Nanshan we have from report of Gen. McArthur, the following statement of the expenditure of ammunition, which was given out officially by the Japanese authorities: 1st Division, 667,010,—3d Division, 425,148,—4th Division, 1,110,086.

The following is from Col. Morrison's report: "In the attack made from the right of the Japanese 2d Army on the early morning of August 31st, one of the battalions started in before daylight, was at short range, and maintained a fierce fight all day. The firing line started with 200 rounds per rifle and fought it out until dark without a fresh supply. The 20th Infantry in the attack on the inner line at Liao-Yang was continuously in action September 2d and 3d, and very heavily, expended the following amount of ammunition; 1st Battalion, 109,964,—2d Battalion, 52,000,—3d Battalion, 79,764. This would give you an expenditure per rifle, if battalions were full, of 125, 60 and 96 respectively. In the attack on the village of Su-li-ho, in the advance on the Scha-ho, the men on the firing line expended only a few shots over 100 rounds per man, the reserve none.

On the Russian side we have but little data. It is well known that their expenditure was great. Col. Macomb reports that the 34th East Siberian Rifles at Liao-Yang in three nights and two days expended 1,200,000 rounds. August 31st, the 122d Infantry Regiment expended 308,000 and the 123d. 450,608 rounds.

I was over much of the Russian position at Liao-Yang a few hours after captured. Everywhere in the position were many cartridges, in places piles of boxes still unopened. Possibly a part of the enormous expenditure by the 34th Siberian Rifles is thus accounted for."

Balck (1899) thus summarizes his views as to the necessary number of cartridges for a battle:

"We should not, of course, imitate the frequently foolish way in which the Chileans and Turks fired enormous quantities of ammunition at extreme ranges, although it occasionally produces some effect. This procedure on their part was due solely to defective musketry training, absence of all fire control, and want of discipline. The instances that have been cited show that, as a rule, 100 to 250 rounds per rifle are sufficient for a general action. Cases may occur, however, when it would be an advantage to have more, and this must be provided for in fixing the amount of ammunition, both that carried by the soldier and that carried in the small arms ammunition carts provided for infantry in the field. It must also be borne in mind that it is only when each Army Corps has a separate road to march on that it will be possible to replenish the ammunition from the ammunition columns after a battle. If, however, it is not practicable to allot a separate road to each army corps, it will be next door to impossible to replenish the ammunition except after the lapse of some time."

DEDUCTIONS.

(BY COL. J. F. MORRISON.)

It may be assumed that every man on the firing line should have with him or be furnished during the action ample cartridges to see the fight through, and to be able, whenever it will be effective, to fire upon the enemy; yet too many cartridges carried by the man unnecessarily increases his load and thus reduces his mobility.

With battles lasting from two to four days, it is not absolutely necessary that the men carry enough into action to last through. It should be possible to re-supply the line at night. To re-supply during the day is often impossible and always difficult. It would therefore appear that every man who goes on the firing line should have with him enough cartridges to see the fight to an end or until darkness gives opportunity to replenish his stock.

This number will vary with many conditions. To win you must produce a certain moral as well as physical effect on your enemy; in other words, you must produce in his force a loss sufficient to cause him to abandon the action before you yourself meet the loss beyond which your men will not continue to fight.

Troops who are well trained and properly instructed in the use of their rifle will produce a given number of casualties with many less cartridges than would be expended by raw, half-trained troops in accomplishing the same result. The kind of troops you are opposed to will affect the number materially, some require much

"more killing" than others, to satisfy them. The better the enemy shoots, the more your men's aim will be affected; hence, the more shots necessary to a hit. Increase of range at which fire is opened increases consumption of cartridges, as the percentage of hits will be less, the longer the range. The kind of target offered varies the number of rounds necessary to get the requisite number of hits.

Improvements in the rifle affect the number of cartridges necessary. It does not depend, however, on its rapidity, so much as other points. In the War of 1866, the Austrians used a muzzle-loader whose rapidity of fire was three shots per minute; the Germans used a breech-loader whose rapidity was fifteen shots per minute, yet the Austrians fired more shots per rifle engaged than the Germans. But it was the hits that counted.

In the Thirty Years War it is reported that it took about 2,000 shots to disable a man. "During the Battle of Leipsig, which lasted two days, the Allies fired 12,000,000 cartridges and disabled 45,000 French, which represents the expenditure of 266 rounds per man disabled."

As our rifles are improved, become more accurate and reliable, a given effect can be produced with less shots. Unless men are braver and steadier under danger than formerly, the same loss will break our lines and cause retreat now as heretofore. The rapidity with which the loss is inflicted will sensibly reduce the amount necessary to produce a required moral effect.

Colonel Mayne says: "A loss of ten per cent inflicted within a few minutes will probably stop and even drive back troops who would willingly endure a gradually inflicted fifty per cent or even greater loss spread over two or more hours of fighting."

From the data we are justified in saying that with reasonably good troops, both as to discipline and musketry training, 200 cartridges per man should be sufficient to see him through a day's fighting, and ordinarily would be greatly in excess of the number fired, but the number available must be the maximum that may be required, provided it is not more than the men can carry; and General Rhone, German Army, states: "We can count with certainty only on the ammunition of the first line."

Will this number suffice for us? If we could have only troops like the regulars of 1898 it would be ample and to spare. With troops such as we are likely to have at the commencement of a big war, men with little discipline and musketry training, it will be none

too great, if it be large enough. But, as in South Africa, "Experience will bring its lesson of thrift in expending ammunition,"—our men learn fast. The minimum available should be fixed at about 200 and in the earlier stages of the war made greater if practicable."

Let us now glance at the arrangements in other armies for solving this problem:

Distribution.

	1st Echelon			2d Echelon.	Total, 1st 2nd 2d Echelons.
	On the Man.	Bat. or Co. Carts.	Total.		
Austria	120	40	160	75	235
England	100	93	193	77	270
Indian Army	100	80	180	120	300
France	120	65.5	185.5	110.4	295.9
Germany	120	72	192	130	322
Italy	162	23	185	---	---
Japan	150	59	209	100	309
Russia	120	66	186	72	258
Switzerland	120	52	172	---	---

Our present regulations call for 100 rounds to be carried by the man and 46,500 rounds on the mules of a machine gun company. The remainder of the first echelon is put up in bandoliers each, holding 60 rounds packed 20 in a box. By assigning two four-horse wagons to a battalion, we can carry two bandoliers per man, giving us 220 rounds per man for the first echelon—100 on the man and 120 in the wagons. Is this a proper division between man and wagon?

Colonel Morrison has this to say on the subject:

"There can be no exception taken to this division except having two wagons, and these we must have or add one of the bandoliers—4½ pounds—to the man's constant load. It is believed that the wagons are cheaper. Outside our little regular army, in a big war, the additional load of 4½ pounds means many more men will break down, and it is believed that with the increased load they will march slower and straggle enough to more than make up the difference in the length of the column. If we lose nothing in length of column the only drawback is cost, and in this country the mules are cheaper than the men; and moreover, at first, money is about the only useful thing we will have in abundance."

The next question to take up is the proper vehicle for our combat

wagon. In foreign armies this immediate reserve supply is transported thus:

Austria,—similar in form to an artillery caisson, drawn by two horses, capacity, 9,450 cartridges.

England,—at present, two-wheeled cart drawn by two horses. Capacity, 17,600. In addition each battalion has two pack animals.

Japan,—eighteen pack ponies to a battalion.

Germany,—four-wheeled four-horse wagon of special construction.

France,—two-wheeled cart drawn by two horses—horses either abreast or tandem. Capacity, 16,384.

Russia,—two-wheeled carts, 2/3 one-horse, 1/3 two-horse, capacity 6,000 and 14,400.

Switzerland,—two-horse four-wheeled carriage; in general pattern like our caisson; capacity 17,280.

Spain,—two-wheeled cart drawn by two mules; capacity 15,000.

Turkey,—pack animals only.

Again quoting Colonel Morrison:

"The only wagon or cart we have at present for transport of ammunition is the escort wagon. With the exception of Germany, no other country uses a four-horse wagon. Japan uses pack ponies exclusively; England, two-horse, two-wheeled carts and pack horses; Russia two-horse and one-horse carts, two-thirds being of the latter. All the others use two-horse vehicles, generally two-wheeled carts.

"The advantages of the pack animal are many, the principal ones being that they can go where wheels cannot, and when necessary to take them under fire offer a small target. But their disadvantages are also great; unless they are led, they take up much room on the road, and too many animals have to be foraged for the load carried. The advantage claimed for the two-wheeled cart are that it can be taken over ground impossible for a four-wheeler and carries as much load per animal as the latter.

"The best vehicle is undoubtedly a wagon built on the pattern of the artillery caisson. In every deployment of an army, there will be parts of the line which, owing to the nature of the ground, cannot be reached by a four-wheel wagon and some that cannot be reached by any transport but packs. With a wagon of the caisson pattern provided with a pack outfit for the leaders we have the advantage of all the systems. We have the four-horse four-wheeled wagon where it can be used, the cheapest one as to men, horses, and space on the road. By taking the leaders off and unlimbering we have with the wheelers the very best of carts, and the leaders can be used to pack. They should be provided with a special pack saddle, however.

We can not in war time train all our infantry to pack on the aparejo, we must have something any one can use; besides, the aparejo is unnecessarily heavy to be carried along for this purpose. Until we get the caisson the pack outfit should be provided for the leaders on the escort wagons, that we may have something available more mobile than a four-horse wagon."

In 1910 the War Department appointed a board, consisting of Major McIver, Captain Stewart, of the Infantry, and Lieutenant Clopton, of the Cavalry, to consider, among other things, the proper carriage for Infantry combat wagons. This board was impressed with the desirability of having some kind of a caisson wagon so arranged that it could be uncoupled and the lead pair hitched to the rear half; also of having packs for the leaders. In experimenting with a wagon, the board confined its efforts to modifying a standard escort wagon which was not very successful. They devised a pack and recommended that it be perfected and adopted.

FIELD ARTILLERY.

As to the expenditure of ammunition by the Field Artillery, the following figures are of interest:

"1813. Battle of Leipzig: Average for the Austrian guns, 199 rounds per gun in the three days, or 66 per gun per day.

"1863. Battle of Gettysburg: Federal average for the 320 guns in action, 102 rounds per gun in the three days, or 34 per gun per day. Greatest expenditure reported by any one battery, 1,380 rounds in three days, by battery "G," Fourth U. S. Artillery—an average of 77 rounds per gun per day.

"The Confederate reports are incomplete, but the expenditure was approximately 100 rounds in the three days for each gun engaged. The greatest reported expenditure by one battery was 882 rounds for four guns, or 73 per gun per day.

"1866. Greatest expenditure in one day by a Prussian battery, 180 rounds per gun, at Blumenau; by an Austrian battery, 217 per gun, at Königgrätz.

"1870. Vionville: Prussian average, 89 rounds per gun; 35 per cent of the batteries fired over 100 rounds per gun.

"Gravelotte: Prussian average, 55 rounds per gun; 16 per cent of the batteries fired over 100 rounds per gun. French average, 90 rounds per gun; 86 per cent of the batteries fired over 100 per gun, but no battery fired more than the supply normally carried with it in caissons and limbers.

"1904. The expenditure was greatest on the Russian side. At the Sha-ho, the artillery of the Thirty-fifth Division averaged 278

rounds per gun per day. At Liao Yang the artillery of the First and Third Siberian Corps averaged 420 rounds per gun per day. Colonel Patchenko's battery, above mentioned, fired at Tashihchiao 522 rounds per gun; this is the greatest expenditure reported for a single battery on one day.

Our present regulations call for:

190 rounds with the firing battery
168 rounds in the combat train
358

which, considering past experience and probable future requirements, seems ample for a day's engagement. While individual batteries might consume more than this, the sum total for the divisional artillery need not exceed the 358 rounds, and individually deficiencies can be equalized by transfer of ammunition from other batteries, on the firing line.

It is very essential that the combat reserve ammunition of the artillery be carried in caissons, and never in escort wagons if it can be avoided. The escort wagon can carry only about a hundred rounds and is not sufficiently mobile then to always be able to follow the firing battery. The boxes are difficult to open, and a box holds only 4 rounds. The caisson and its limber carries 106 rounds immediately available, and the limber, team, pole, wheels, etc., are interchangeable with corresponding material in the firing battery.

THE SECOND ECHELON.

This, it will be remembered, is the ammunition of the Division Trains.

Quoting the F. S. R. we have as this supply:

"219. *Ammunition Trains.*—The ammunition train of a full *division* is normally loaded as follows:

"(*a*) For small arms (three-wagon companies, 81 wagons) 77 wagons, each with 25 boxes (1,200 rounds per box) or rifle and 1 box (2,000 rounds) of revolver ammunition, and 1 wagon with 30 boxes of revolver ammunition.

"(*b*) For artillery (2 wagon companies, 54 wagons) 51 wagons, each with 25 boxes (4 rounds per box), and 1 wagon with artillery stores.

"If available, caissons instead of wagons may be used for carrying

artillery ammunition. Each caisson carries 106 rounds, or 48 caissons would carry about the same as 51 wagons.

These five wagon companies comprise the division ammunition train, which is brigaded, so to speak, with the other train-supply companies (forage and subsistence), under command of the Commander of the Trains, an officer detailed by Division Headquarters.

The division ammunition train adds 120 cartridges per rifle, and 106 rounds per 3″ gun to the division supply, or a total at the disposal of the division commander of 340 cartridges and 646 rounds for the 3″ gun.

THIRD ECHELON.

This comprises all behind the division. In general it is prescribed that the amount at the advance supply depot shall be kept equal to this amount, that is, 330 rounds per rifle and 464 per gun, or a total at the front of 660 rounds per rifle and 928 rounds per gun, and at the base or in arsenals convenient thereto, there is kept an amount equal to these figures, giving a grand total in the theater of war of 1320 rounds per rifle and 1,856 per gun.

PERSONNEL OF THE AMMUNITION SUPPLY SERVICE.

"The field service regulations are more or less ambiguous concerning this feature of ammunition supply, the following only relating to the subject:

"Section 16 shows that the smallest unit to receive a chief ordnance officer is the Field Army. Likewise that with the headquarters of the line of communication a chief ordnance officer is detailed. This is the only place in the regulations where specific provision is made for the assignment of an officer for duty in connection with ammunition supply.

"On page 41 the Field Service Regulations provide for a 'commander of trains' to be appointed by the commander of the division or other unit, but it is not prescribed whether in this general scope a commander of an ammunition train will be included whose sole duty is that of superintending the ammunition supply for the division."

That the detail of a commander for the ammunition column is contemplated by the F. S. R. is evident from this quotation from paragraph 219:

"If no orders have been received and firing indicates that a serious engagement has begun, the ammunition train moves to a favorable position and its commander places himself in communication with the Division Commander and the commander of the artillery."

Paragraph 235 quoted below also indicates that there is to be such a functionary:

Section 234 provides in part that the combat wagons "Ordinarily are commanded by supply officers or by experienced noncommissioned officers,' but fails in any manner to provide by whom and for what particular sections these officers or noncommissioned officers are appointed."

Section 235 provides that "Ammunition trains are usually commanded by artillery officers assisted by infantry and cavalry officers who will have immediate charge of small-arms ammunition supply in combat."

Page 141, the foot-note provides, "During combat the company mess sergeants and cooks and the battalion supply sergeants join their battalion combat trains, unless otherwise ordered, and assist in the distribution of ammunition.

In all of the foregoing cases the regulations are silent as to the exact duty that should be required of these various commanders. Their zone or extent of responsibility is not fixed nor is there any particular method prescribed assuring coordination of the different functions involved, so that in times of war, or during an engagement, the system would work out.

The Infantry Drill Regulations prescribe the following:

"547. The method of supply of ammunition to the combat trains is explained in Field Service Regulations.

"548. The combat train is the immediate reserve supply of the battalion, and the major is responsible for its proper use. He will take measures to insure the maintenance of the prescribed allowance at all times.

"In the absence of instructions, he will cause the train to march immediately in rear of his battalion, and, upon separating from it to enter an engagement, will cause the ammunition therein to be issued. When emptied, he will direct that the wagons proceed to the proper rendezvous to be refilled. Ordinarily a rendezvous is appointed for each brigade, and the necessary number of wagons sent forward to it from the ammunition column.

"549. When refilled, the combat wagons will rejoin their battalions, or, if the latter be engaged, will join or establish communication with the regimental reserve.

"550. Company commanders are responsible that the belts of the men in their companies are kept filled at all times, except when the ammunition is being expended in action. In the firing line the ammunition of the dead and wounded should be secured whenever practicable.

"551. Ammunition in the bandoliers will ordinarily be expended first. Thirty rounds in the right-pocket section of the belt will be held as a reserve, to be expended only when ordered by an officer.

"552. When necessary to resupply the firing line, ammunition will be sent forward with reenforcements, generally from the regimental reserve.

"Men will never be sent back from the firing line for ammunition. Men sent forward with ammunition remain with the firing line.

"553. As soon as possible after an engagement the belts of the men and the combat wagons are resupplied to the normal capacity. Ammunition which can not be reloaded on combat wagons will be piled up in a convenient place and left under guard."

The Field Artillery Drill Regulations prescribe the following:

"881. *General Method of Supply*.—Ammunition is supplied to field artillery in campaign in the following manner:

"(*a*) The ammunition of the firing battery is replenished from the caissons of the fifth section, which in turn are replaced by caissons from the battery combat train.

"(*b*) Combat trains are replenished from the ammunition trains, which in turn are refilled at the advance-supply depots. In exceptional cases issues are made direct from depots to combat trains.

"(*c*) Advance supply depots are supplied from ammunition depots at the base of operations. For this service the commander of the lines of communication is responsible.

"Base ammunition depots are supplied from arsenals.

"882. *Amount of Ammunition to be Supplied*.—The ammunition on hand at the beginning of a campaign, together with the facilities for manufacturing, should be sufficient to insure the maintenance at all times of at least 1,856 for each light gun.

"The following table shows how this ammunition is distributed:

Location.	Rounds per gun.
With the firing battery	190
With the battery combat train	168
With the ammunition train	106
At the advance supply depot	464
Total at the front	928
At the base or in arsenals convenient thereto	928
Total in the theater of war	1,856

"Horse artillery operating with cavalry divisions is not usually accompanied by ammunition trains, but replenishes its supply from the nearest division. The limbers of horse batteries are not, as a rule, filled with ammunition.

"883. *Organization of Ammunition Trains*.—Field artillery ammunition trains vary with the types of guns with which the field artillery brigade of the division is equipped.

"One caisson, with the necessary personnel, animals, etc., is provided for each light gun in the field artillery brigade. These caissons, together with the necessary officers, battery wagons, store wagons, field wagons, etc., are grouped together to form organizations of convenient size. As a rule the unit of actual supply to the firing battalions or its combat train is composed of 12 caissons. Two of these units or half batteries are grouped to form an ammunition battery. The three ammunition batteries of the division form a battalion, which is known as the field artillery ammunition train.

"When caissons are not available they are replaced by field wagons. The organization of the ammunition trains is shown in Appendices 4, 5, 6, and 7.

"884. *Position of Combat Trains and of Ammunition Trains*.—On the march the battery combat trains march either with their batteries, united in rear of their battalions or regiments, or united in rear of the column. In action the combat trains are generally assembled by battalion and are posted about six hundred yards in rear of the artillery line of battle.

"When action is imminent the ammunition train marches, as a rule, in rear of the main body. At the beginning of an engagement the artillery ammunition train is directed to proceed to some suitable location from which practicable routes radiate to the firing batteries. As a rule the most suitable preliminary location is found at a distance of from 2 to 3 miles in rear of the line of firing batteries. Inasmuch as the expenditure of ammunition will not be the same for all the batteries, it is, as a rule, desirable to hold the ammunition train together during the earlier stages of the engagement. As the probable course of the engagement becomes known, it may be advisable to subdivide the ammunition train and station the subdivisions at such places as will facilitate the supply of the battalion combat trains.

"885. *Communication*.—The commander of the field artillery ammunition train furnishes an agent to connect the field artillery commander's headquarters with the ammunition train. Similarly, the commander of a subdivision of the ammunition train furnishes an agent to connect with the combat train or with the headquarters of the unit to which the subdivision is assigned.

"The commander of the combat train furnishes an agent to connect the headquarters of the unit with the train.

"886. *Responsibility for the Supply of Ammunition*.—The supply of ammunition is effected from the rear to the front. It is the duty

of the commander of each unit in the ammunition supply system to ascertain the position of each of the units which he is to supply and to establish contact with such units. Thus, if the ammunition train is to remain intact and is to supply the combat trains of four separate battalions, it is the duty of the ammunition train commander to locate the position of each of the combat trains, reconnoiter the approaches thereto, and to make every arrangement for keeping himself informed as to the needs in ammunition and for the prompt resupply of the combat trains. The troops engaged in battle must be kept free from all anxiety as to the ammunition supply.

"The general control of the ammunition supply with the field artillery brigade rests with the brigade commander. The field artillery brigade commander must keep himself informed as to the expenditure of ammunition, and must take the proper steps to replenish the supply from the advance supply depot.

"887. *Details as to Positions for Ammunition Trains.*—The position selected for the field artillery ammunition trains should afford free access from all directions, should afford ample room for posting the carriages so as to leave room for a third carriage to be driven between any two adjacent carriages, and should be so located as not to interfere with the movements of other troops or trains. If for any reason it becomes necessary to halt carriages upon a road, they must be formed on the right-hand side, leaving sufficient space on the road for the passage of other vehicles.

"All routes leading from the position of the ammunition train must be reconnoitered and arrangements made for the probable movements of the train.

"888. *Details of Ammunition Supply in Action.*—During a combat the ammunition expended by the guns is replenished from the caissons of the fifth section, generally during lulls in the action. The empty caissons of the firing battery are replaced by caissons of the battery combat train. In urgent cases caissons may be sent directly to the firing battery from the ammunition train.

"The ammunition of the gun limbers is ordinarily maintained as a last reserve. The emergency ammunition on the guns is used only in extreme cases and must be immediately replaced.

"Empty caissons returning from the firing battery to the combat train are refilled from the caissons of the ammunition train. The filled caissons and the empty caissons are placed alongside of each other and the transfer of ammunition is effected under the direction of the combat train commander. The empty caissons of the ammunition train must be sent back promptly to be refilled. This refilling may take place at the advance supply depot or at some point in advance of that depot. In the latter case the ammunition is brought forward from the advance supply depot in ordinary wagons. In either case the refilled caissons rejoin the train to which they belong.

"The position of an ammunition train is marked by a red flag during the day, and by a red lantern at night."

These drill regulations also contain the complete organization tables for the ammunition supply service of the artillery of a Field Army, but as these have been changed in the Report of the General Staff to be discussed later, no further mention will be made of them.

The Cavalry Drill Regulations are silent on the subject except in paragraph 539, where, under the head of Extended Order, it states:

"He (the captain) directs the action of the troops, keeps up the supply of ammunition, regulating its distribution and expenditure."

It is evident from the foregoing that a definite personnel should be provided for the Division Ammunition Train and our F. S. R. on the subject amplified. The General Staff has done this in its recent report on the "Organization of the Army," which will be referred to later.

Considering the Infantry Drill Regulations on the subject, it will be seen that in the absence of orders to the contrary:—

"(*a*) Combat wagons will march in rear of their battalions as a part of the major's command, and to put them elsewhere will require orders from colonels or superior commanders.

"(*b*) When ordered elsewhere (consolidated in rear of regiments or brigades for example), they pass to the command of the colonel or brigadier and are no longer subject to the major's orders.

"(*c*) Ordinarily and especially when combat is imminent these wagons will march as in (*a*). That is, there will be no change from the normal except for good and sufficient reasons.

"(*d*) Wherever they march, they are subject to the orders of the commander of that unit and of course to the orders of his superiors.

"(*e*) The majors are required to issue this ammunition to their battalions 'upon separating from it to enter an engagement' when the wagons are under their command. In the absence of orders to the contrary each major must make the decision as to what constitutes a separation from it to enter an engagement.

"(*f*) If it is not desirable for tactical or other reasons to march the wagons in rear of battalions or if they are marching there and it is not desirable to issue the ammunition, a situation which will very frequently occur, then regimental, brigade or division commanders must specifically direct that the ammunition for such battalions or such regiments will not be issued."

Upon the above quoted regulations the majors are required to issue upon separating from the wagons to enter into an engagement.

Let us now see what reasons there may be which would induce regimental and superior commanders to order "no issue." This must be, as in all military decisions, the result of our estimate of the particular situation and it would seem that the *probable length of time of the engagement,* and *ability to immediately resupply probable amount expended are* the two principal variables in the equation to be solved. Fixed values assigned these variables from our estimate should give the required answer. In arriving at a fixed value for these variables the following may be of assistance:

(a) If ammunition is plentiful, better lose a wagon load than that a company should lack a single bandolier on the firing line.

(b) Marching with the extra ammunition on the person is much slower and more fatiguing.

(c) Ammunition discarded may be recovered in an advance, but not so readily in a retreat.

(d) Resupply is easier in an orderly retreat than in an advance as the required ammunition may be dropped by the wagons in sheltered places and picked up by the passing troops.

(e) Think carefully before you permit issue prior to short advance and rear guard actions, or in "positions in readiness" where you may march again before combat or where you may have no combat at all. In these cases "no issue" should be ordered or the majors may empty their wagons.

(f) The cream of the discussion is that the foot soldier carries on his person 100 rounds. Is that enough for his purpose in carrying out your orders and can you quickly resupply the amount he expends, thereafter?

Another point to be observed in the foregoing regulations is that the brigade commander should ordinarily designate the rendezvous for the empty wagons. This is essential as may well be imagined when you consider that nine majors in your brigade may empty eighteen wagons which must be given a rendezvous to prevent their aimless wandering in the backyard of your brigade, and that you must select a point to which yau may request the division commander to order a part of the division reserve supply. This rendezvous should not be far to the rear.

Quoting Colonel Morrison:

"The company or battalion cart having been emptied should not go back to the ammunition column for a resupply, but wagons should

be sent forward from the column to resupply the battalion wagons. This certainly seems to be the rational course. At the commencement of an action, particularly if the deployment takes place from column, there is a movement forward, wagons going back from the leading brigade to the division trains would have a hard time and would probably be a considerable nuisance to others, the division wagons coming forward would be within the current and would move with much less difficulty and much more rapidity, and the time occupied before the battalion wagons are refilled and back to the vicinity of their battalions will be much less than half of what it would be if the battalion wagons were to go to the division train."

FIELD ARTILLERY.

A similar discussion applies to the battery combat trains of the field artillery when not marching with their batteries. Each *firing battery* carries 190 rounds per gun. Each gun can, but ordinarily would not, fire 16 aimed shots per minute. The withdrawal of the battery combat trains from the firing batteries is made to lessen the depth of your combatant column and to increase the mobility of the batteries. Due to the fact that some batteries may have an excessive expenditure of ammunition, it is ordinarily better to put the combat trains when thus consolidated at the disposal of the artillery commander upon entry into combat, but look carefully at the situation, especially in the class of actions noted before, viz: rear-guard and advance-guard actions when the combat may be brief, and in other cases when you may have no combat at all.

The Infantry Drill Regulations assign the combat wagons normally to the battalions and they march in rear of the same. Concerning this procedure, Colonel Morrison has this to say:

"As to the place of these wagons on the march, the consensus of opinion in all leading armies is that they should not be separated from their battalions. It is not deemed possible to collect them by regiments or brigade and promptly issue the ammunition when needed. Even from battalion carts it is not always possible to distribute it.

As a result of experiments conducted in Germany it was found to be practicable on the defense, on the deliberate offense; but on the rencontre fight the first companies which had to deploy directly from column often lacked opportunity to distribute the contents of the wagon among the men. In back of the brigade or even regiment it will be still more difficult, and still more companies would go into action without extra ammunition."

Concerning replenishment on the firing line the following is largely from Col. Morrison:

The regulations of most countries contain a clause directing the collection of the ammunition on the dead and wounded and its distribution among the others. There are writers who claim this cannot be done on the offensive and the regulation a mistake, others claim that a special detail should follow the lines and do this to prevent delay in the firing line. It would seem to be asking a good deal of a man to follow the firing line and gather up this ammunition and distribute it along the line, in other words, to expose himself to many times more risk than the firing line without the opportunity of "shooting up his courage" that the firing line has. Still there will be in a battle, and on the offensive, many opportunities to get ammunition from the dead and wounded. The line is not continually moving and when stationary the wounded in that position can often pass what they have to their neighbor and others can get ammunition from those killed and wounded near by. Every proper effort should be made to make use of this ammunition and much, although not all, can undoubtedly be secured.

Colonel Mayne recommends the retaining of thirty rounds as a reserve to be fired only by direction of an officer. This is believed to be a wise and practicable regulation. This going forward in attack and being checked, then going back to the starting point, unless literally driven back, is not good tactics. If you get cover and hold the ground gained, waiting for darkness or reenforcements, you must be prepared to check a counter attack, and there is always danger of many men recklessly shooting away their ammunition. This reserve may be of vital importance when the counter attack is made or when the enemy gives you a fine opening for pushing the attack. Captain Matsui commanding a battalion of the Japanese Army in his attack on "Scrub Hill," August 31st, had just such a situation and ordered fifty rounds held as reserve to be fired only by his order.

All parts of a line are seldom called upon to fire an equal amount of ammunition. Captain Balck and Colonel Mayne are agreed that with disciplined troops, the passing of ammunition along the line to points where most needed is not very difficult.

In spite of precautions, portions of the line may run out of ammunition and have to be resupplied. Two methods laid down

in many of the regulations are generally, though not always, practicable.

The first is to give extra ammunition to the supports and they are sent forward into the firing line, this extra ammunition to be distributed on reaching the line. This is practicable wherever supports can be sent forward and was used in the late war in Manchuria; another is to send men forward with ammunition in bundles or any convenient way of carrying it. This was used by the Japanese in Manchuria and is practicable whenever the first method is, that is, whenever men can cross the ground behind the firing line.

Both these methods have been embodied in the regulations of most European countries for years. Under cover of darkness or favoring terrain either may be a simple way of replenishing ammunition but under ordinary conditions it will be difficult and sometimes almost impossible. The firing line must have ammunition, they should and generally will, if reasonably good troops and properly handled, take into action enough to last them through the fight or until darkness favors a resupply. But it will happen that they will run short for some reason and must be resupplied. The battalion wagon or a part of it should be as near as practicable. If the line is to be reinforced, these reinforcements should take the ammunition with them. It is the rational method; they have to cross the fire swept zone any way and the increase in weight will not be as great a drawback for the comparatively short distance they must cross. Individual men should not, as a rule, be sent forward to carry the ammunition; if done at all it should be done by groups under a noncommissioned officer, and having reached the firing line they should stay there. Men who have reached a position near the enemy represent a gain that has cost more or less blood to get, and it certainly is not good policy to send men back over this zone at a cost equal to getting them up there when that line is where the men are most valuable.

Of course, under cover of darkness, or exceptionally favoring terrain men may go back and forth from the nearest supply to the line with little danger, but under ordinary circumstances, even if men could be found to do it, it would border on the absurd to detail men to go back and forth between the firing line and the ammunition supply in rear. At Modder River the English Guards remain lying down for twelve hours at seven hundred meters from

the enemy; twenty-nine carriers were killed trying to replenish their supply of ammunition.

An English writer suggests hauling bundles of ammunition forward by ropes, if necessary, shooting a cord to the firing line with a special rocket and thus hauling across a carrying cable.

We may assume that the method we have read of being used in the Civil War of marching a regiment to the rear to replenish its cartridge boxes, will hardly be used in future with long range and rapid fire rifles and improved artillery. Other schemes have been proposed but do not appear to the tacticians of Europe to promise to be of value.

The best scheme is to have men fairly well disciplined and instructed in musketry, then give them a reasonable supply of cartridges before entering on the fight, and they will generally have enough to last the fight through or until night gives opportunity to resupply.

As previously mentioned the General Staff in its recent report on the Organization of the Land Forces of the U. S., organizes the ammunition service as follows:

AMMUNITION SERVICE.

The proposed organization of the divisional ammunition service is as follows:

	Officers.	Veterinarians.	Men.	Vehicles.	Animals.
First Battalion:					
Staff	2	1	9	---	12
Gun ammunition company	3	--	149	57	182
Howitzer ammunition company	3	--	163	28	211
Infantry ammunition company	4	--	145	59	266
Total	12	1	466	114	671
Second Battalion:					
Staff	2	1	9	---	12
Artillery train company	5	--	181	56	345
Infantry train company	4	--	145	59	296
Total	11	1	335	115	653
Divisional ammunition service:					
Staff	2	1	8	---	11
Grand total	25	3	809	229	1,335

Staff of an Ammunition or Train Battalion.	Staff of Headquarters Divisional Ammunition Service.
1 major.	1 colonel or lieutenant colonel.
1 lieutenant.	1 lieutenant.
1 veterinarian.	1 veterinarian.
1 sergeant-major.	3 sergeants, 3 corporals, agents and scouts.
3 sergeants, agents and scouts.	2 privates (horseholders and orderlies).
3 corporals,	
2 privates (horseholders and orderlies).	

The complement proposed for the Army ammunition service is a battalion of two batteries; the staff of the battalion to be similar to that of a divisional ammunition battalion; the strengh of each company to be the same as that of the howitzer ammunition company given above.

If it is deemed desirable to provide a separate ammunition service for the cavalry division, the complement for this duty should comprise a battalion of three companies each giving the strength of the gun ammunition company given above.

For economic reasons it is not considered desirable to maintain complete ammunition organizations in time of peace. A peace nucleus must be provided and all plans carefully worked out for securing the personnel necessary for passing to the war basis. To organize at once an effective service there must be a proper reserve system.

For the divisional ammunition service, a lieutenant colonel of one of the Artillery regiments should be designated as chief of the service and should be charged, in peace, with the detailed preparations for passing to the enlarged war footing. The third batteries of the two howitzer battalions of the division should constitute the nucleus of the ammunition service. All the officers and a limited number of enlisted men of these batteries should be maintained in peace; they may be employed on militia or other duty, but should be assembled at maneuver camps periodically for practicing, on a reduced basis, their appropriate duties in the ammunition service. On mobilization, the captains of these two skeleton batteries should be given temporary commissions as majors; the six lieutenants should be given temporary commissions as captains. A major would thus be provided to command each battalion, and captains would be provided to command the three companies of the first battalion and the two companies of the second battalion. The extra captain would be a staff officer for the lieutenant colonel. The remainder of the officers would be reserve officers, designated in time of peace for their particular positions. There should be enough enlisted men in the two skeletonized howitzer batteries to provide a staff sergeant for the lieutenant colonel and each of the two majors

and at least six noncommissioned officers for each ammunition or train company, thus making a total of 33 men for the two companies.

An effort should be made to enroll reservists and volunteers in the particular district in which the division is serving to make up the remainder of the enlisted strength.

For the Army ammunition service the lieutenant colonel of the Heavy Artillery regiment should command the battalion, and the skeletonized batteries should have, on the peace basis, a nucleus of officers and men.

Similar arrangements may be made for the ammunition service of a Cavalry division.

DETAILS OF DIVISIONAL SERVICE.

Field Artillery.

The experience of recent wars seems to indicate that for the light field piece (3-inch) there must be maintained on wheels, in front of the advance supply depot, approximately 500 rounds per gun.

The supply to be thus maintained for the howitzer and other heavier calibers is not so well established. In an important engagement their expenditure will be great also, but as each wheeled vehicle can carry but a very limited number of these heavier projectiles, and the number of such vehicles must be kept down to the very minimum in order to reduce length of trains, it is evidently impracticable to keep anything like 500 rounds per gun on wheels for these calibers. Similarly, the number to be so maintained on pack mules for the mountain howitzers must be less than 500.

The number to be maintained on wheels or packs for the different calibers is estimated as follows:

	Rounds.
For the 3-inch rifle	464
For the 3-inch mountain howitzer	290
For the 3.8-inch howitzer	312
For the 4.7-inch howitzer	180

As for the distribution of the foregoing ammunition, the best practice seems to be to keep with the guns and their combat trains a number sufficiently large to give them a reasonable insurance against exhaustion of ammunition before resupply commences, and to keep in the ammunition column the remaining amount as a rolling reserve to be served out to the various battalions and batteries in accordance with their expenditures.

On the basis of 3 caissons on 17 pack mules per gun the following are the amounts to be kept with the guns and their combat trains:

	Rounds per gun.
For the 3-inch gun	358
For the 3-inch mountain howitzer	170
For the 3.8-inch howitzer	168
For the 4.7-inch howitzer	90

The following, then, remain to be carried in the ammunition columns:

	Rounds per gun.
For the 3-inch gun	106
For the 3-inch mountain howitzer	120
For the 3.8-inch howitzer	144
For the 4.7-inch howitzer	90

Such being the amounts of ammunition to be carried by the divisional ammunition column, we may decide what the composition and organization of this column should be.

The function of the column is to receive ammunition from the line of communication troops and transfer it to the combat trains of the batteries. The distance to be covered in making this transfer may vary very considerably. The average distance to be traversed may be assumed as one-half day's march; this on the assumption that the advance supply depot will be located one day's march in rear of the combatant troops and that the line of communication troops will feed sub-depots for each division a half day's march farther on. A day's march may be taken as 18 miles; hence we find 9 miles as the distance the division train will have to cover on the above hypothesis. If the distance is greater or less than this the amount of ammunition that can be delivered at the front each day will be proportionately diminished or increased.

The first portion of the travel from the divisional subbase toward the front will be on some already existing road, or on one which will have to be immediately blazed out for all the divisional supply trains. On approaching the combatant troops, however, some point on this route will have to be selected from which elements of the column can be sent to the different combat trains. This point may be termed "the distributing point." From here the vehicles will have to move often across country to reach the vicinity of the combat trains. Each element will move up to a convenient point to which empty caissons from the combat trains may be sent to be refilled. It may be assumed that these points are ordinarily about 1 mile in rear of the fighting line, and that the distance to be covered from distributing point will be 3 or 4 miles.

The procedure above outlined seems to be the one that would naturally be followed in the average case. It suggests two things as to the organization and composition of the divisional train:

1. That the train should be divided into two echelons: The first to

have the duty of transporting ammunition from the distributing point to the various combat trains; the second to have the duty of bringing ammunition up the road to the distributing point.

2. That ammunition should be carried in caissons in the first echelon, since all sorts of country may have to be negotiated; while for the second echelon army wagons or motor trucks should be used, inasmuch as a great saving in men, animals, and length of train is thus insured, and inasmuch as wagons or trucks would be entirely suitable for the work to be done.

The foregoing may be accepted as fundamental considerations determining the organization of division trains. Both echelons should be capable of ready subdivision so that full subdivisions may be moving to the front while empty ones are moving to the rear to be filled. When the line occupied by the division is very extended, it may be desirable at times to split the leading echelons in two and send each part to establish a distributing point for supplying its part of the line.

The second echelon should have a section comprising the reserve of men, horses, materiel, and equipment, and also the personnel and equipment for making minor repairs.

Reverting now to the amount of ammunition to be carried by the divisional ammunition column and accepting the fact that, so far as practicable, the total amount should be about equally divided between the two echelons, we have the following:

	First echelon.	Second echelon.
3-inch gun	53	53
3-inch mountain gun	40	80
3.8-inch howitzer	72	72
4.7-inch howitzer	45	45

From these figures we may now deduce the number of caissons, wagons, and packs to carry the amount of ammunition required in each echelon of the divisional ammunition column:

	First echelon— Caissons of packs.	Second echelon— Wagons.
3-inch gun	24	25
3-inch mountain howitzer	144	25
3.8-inch howitzer	12	10
4.7-inch howitzer	12	13

It thus appears that the first' echelon of a divisional ammunition column must have—

24 caissons for 3-inch ammunition.
12 caissons for 3.8-inch ammunition.
12 caissons for 4.7-inch ammunition.

It is proposed to organize these into a gun ammunition company of 24 caissons and a howitzer ammunition company of 24 caissons, each as shown in tables appended hereto.

The second echelon requires 25 wagons for 3-inch, 10 for 3.8-inch, and 13 for 4.7-inch ammunition, or a total of 48 wagons.

It is proposed to organize these into an Artillery train company, as shown in table herewith. If it is found that motor trucks can be substituted for wagons, then the umber of vehicles will be reduced and the personnel will be correspondingly reduced. Attached to the second echelon is the reserve section comprising spare men, animals, matériel, and repair outfits.

If mountain guns are assigned to a division, the composition of the ammunition trains will depend upon whether these guns constitute the only guns of the division or are only a portion of the divisional Artillery. The mountain ammunition company shown in the table attached will transport 40 rounds per gun for 36 guns, or 60 per gun for 24 guns. One company will suffice if only one regiment of the Artillery Brigade is armed with mountain guns, but two must be taken if both regiments are so armed. If battalions of other calibers are present, suitable sections of their ammunition columns must be taken. The figures in tables, just above, are computed on the assumption that one full regiment of 36 guns accompanies the division. In such a case the other Artillery ammunition company would serve the ammunition for other calibers.

INFANTRY AND CAVALRY AMMUNITION.

The amount of ammunition to be carried per Infantry and Cavalry rifle is as follows:

90 rounds per rifle with each man.
120 rounds per rifle in combat trains.
120 rounds per rifle in divisional trains.

	Men.
In a division there will be 9 regiments of Infantry of approximately 2,000 men each, or	18,000
One regiment of Cavalry of 1,200 men	1,200
Making a grand total of	19,200

Multiply by 120 = 2,304,000 rounds = number of rounds in divisional train.

For the machine guns it is estimated that there should be 17,500 rounds per gun with the mobile troops; 4,800 rounds per gun are to be carried with the new machine-gun equipment, thus leaving about 12,000 rounds to be carried in divisional train. There are 6 machine guns for each of the 10 regiments of Infantry and Cavalry, or 60 guns. For these we must have 720,000 rounds. Hence, we have for the total in the divisional train 2,304,000 + 72,000 = 3,024,000 rounds.

To carry this amount and the necessary revolver ammunition, we require 104 wagons for ammunition proper and 4 for other stores, or 108 in all.

It is proposed to organize these into: An Infantry ammunition company of 54 wagons for the first echelon; an Infantry train company of 54 wagons for the second echelon; the details of organization to be as shown in tables herewith.

SUMMARY OF DIVISIONAL SERVICE.

According to the foregoing analysis, the divisional ammunition service comprises:

First battalion:
- 1 gun ammunition company.
- 1 howitzer ammunition company.
- 1 Infantry ammunition company.

Second battalion:
- 1 Artillery train company.
- 1 Infantry train company.

Each of these battalions should be commanded by a major—the battalion staff being as shown in table herewith.

A lieutenant colonel should be in charge of the entire divisional ammunition service, his function being to carry out the orders of the division commander as to resupply of ammunition and to coordinate the workings of all the different elements.

ARMY AMMUNITION SERVICE.

The amount of ammunition to be maintained on wheels for the eight 4.7-inch guns and the eight 6-inch howitzers of the Army Artillery should be:

	Rounds per gun.
4.7-inch guns	336
6-inch howitzers	168
The amounts carried in the combat train are:	
4.7-inch guns	168
6-inch howitzers	84
thus leaving for the ammunition column:	
4.7-inch guns	168
6-inch howitzers	84

For these heavy calibers it is considered that there should be in the Army ammunition column 3 caissons per gun; the first echelon to comprise 1½ caissons per gun (that is, 24 caissons in all), drawn by horses; the second echelon to comprise 1½ caissons per gun (that is, 24 in all) drawn by horses or motors.

THE SHRAPNEL SHEAF AND THE NUMBER OF BALLS WHICH COVER HORIZONTAL TARGETS FOR DIFFERENT HEIGHTS AND INTERVALS OF BURSTS.

Unfortunately there are no data from actual experiments which permit definite statements to be made as to the exact shape of the intersection of the sheaf by varying targets; but as this question is of such interest to the field artillery, this discussion is given, using data available, and in the hope that future experimental firing will be undertaken along lines that will permit definite predictions as to the probable effect which may be expected upon any target from any particular fire for effect.

As Major Tréguier has used the foreign shrapnel, and has given in convenient and easy form certain calculations, these are quoted. As the present shrapnel in the United States service has 252 balls, it is convenient to adopt Major Tréguier's figures in the discussion and then to pass to the United States Shrapnel.

When the shrapnel bursts in the air it forms a sort of little cannon which shoots the shrapnel bullets from their case and disperses them practically in the shape of the cone of revolution whose axis is the right line joining the point of burst, E (Figure 1) with the point of fall of the projectile.

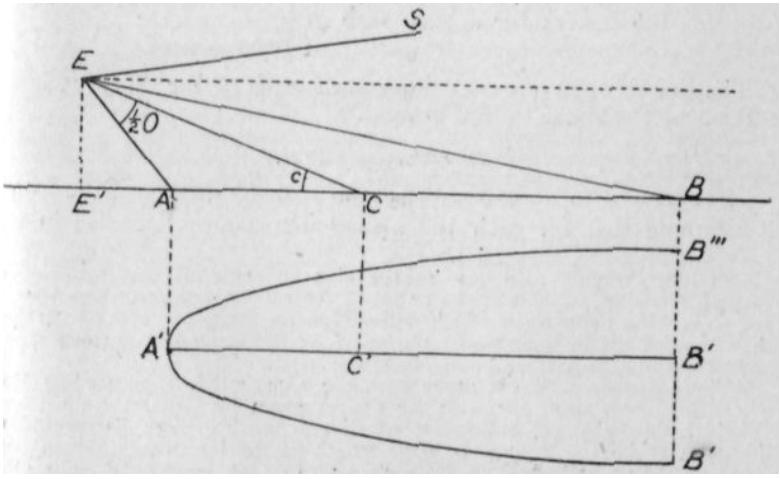

FIG. 1.

For purpose of discussion it is supposed that the balls within this cone have straight line trajectories, which is practically true as long as these balls are not far from the point of burst.

The angle at the summit of the cone is the opening of the sheaf. This opening varies with the range to the point of burst from 12º at short ranges to 20º at long ranges. It is taken as 16º at range of about 3000 yards.*

At distances greater than 4000 meters, one-half the angle of opening, or ½ O, is less than the angle of fall, C, and when this is the case, all the balls are shot towards the ground upon burst; but at distances less than 4000 meters ½ O is greater than the angle at C. It follows that for these ranges, a certain number of the balls are at first shot away from the ground, but in a short time, due to the resistance of the air and to their weight, their velocity decreases and they fall to the ground at points more or less distant from the point of burst. A large number of them reach the ground with a velocity not sufficient to put a man *hors de combat*. These balls are called non-effective.

Experience has shown that a shrapnel ball is usually ineffective when it reaches the following distances from the point of burst:

215 meters for a trajectory of 1000 meters;
185 meters for a trajectory of 2000 meters;
175 meters for a trajectory of 2500 meters;
165 meters for a trajectory of 3000 meters;
155 meters for a trajectory of 4000 meters;
150 meters for a trajectory of 5000 meters.

The line A′B′ (Figure 1) limits the length of the effective intersection of the sheaf by the ground.**

Interval of Burst.

If K is used to designate the number of kilometers in the range, it is found that for each 100 meters increase or decrease in this

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* Modern shrapnel with base charge give an angle of opening probably varying from 12º at short range to 20º at the extreme ranges. Experiments are now being undertaken which will determine for U. S. service shrapnel the shape of the intersection of the sheaf by the ground at various ranges and at varying heights of burst above the ground.

**These distances do not agree with the experiments conducted at Fort Riley, in ctober, 1906, nor with the figures given by General Rohne, both of which show that the bullets are effective at much greater distances from the point of burst. Rohne gives the length of the intersection of effective sheaf by the ground as about 225 meters up to 4,000 meters, 115 meters between 4,000 and 5,000 meters, and about 75 meters for a range of 5,000 meters.

range the angle of departure will increase or diminish approximately by K + 1 mils. If the angle of departure varies by one mil, the range will vary by $\frac{100}{K+1}$. Consequently, if the projectile bursts at E (Figure 1) one mil high, E′C will equal $\frac{100}{K+1}$. If the projectile bursts 2, 3, or 4 mils high, the interval of burst will be 2, 3 or 4 times $\frac{100}{K+1}$.

The following table gives the different values of the interval of burst in meters, for different ranges and heights of burst of from 1 to 5 mils:

———

The Board conducting experiments at Fort Riley give:

1. The front or width of the target effectively covered is between 20 and 25 yards.
2. At ranges up to 3,000 yards the depth effectively searched is about 200 yards—i. e., 50 yards in front of target and about 150 yards in rear of it.
3. At longer ranges, from 3,500 to 4,500 yards, the depth effectively searched is about 125 yards—i. e., about 25 yards in front of the target and about 100 yards in rear of it.

These differences will, however, make little difference in any discussion affecting the fire for effect, for the part of the sheaf in front of target or part A′C′ (Figure 1) will contain one-half the balls in the shrapnel, and the part of the sheaf farthest from the target will contain few bullets; therefore, variations in the length of this part of the sheaf will have but little effect upon the target or upon targets on that part of the ground swept by this part of the sheaf.

General Rohne gives the following widths of the cone of burst of the German (model 1896) shrapnel for a height of burst corresponding to a burst interval of 50 meters in front of the target considered. The widths (in meters) of this intersection with the ground is given for the different ranges at the targets considered and at intervals of 50 meters beyond the target as far as the shrapnel balls have disabling effect.

Range in meters.	Width in meters				
	Target.	+50	+100	+150	+200
1.000	12	24	36	47	57
2.000	14	25	36	47	55
3.000	15	27	32	36	26
4.000	16	22			
5.000	17	0			

The intersections extend in front of the target from 40 meters at a range of 1,000 meters, to 16 meters for a range of 5,000 meters. For the height and interval of burst considered they form closed curves at a range of about 4,000 meters for the height and interval of burst here considered.

Range in meters.	Height of burst above ground in mils				
	1	2	3	4	5
1.000	50	100	150	200	250
2.000	33.3	66.6	100	133.3	166.6
2.500	28.6	57.2	85.8	114.4	143
3.000	25	50	75	100	125
4.000	20	40	60	80	100
5.000	16.6	33.2	49.8	66.4	83

The inferior nappe is the part, AC, of the sheaf, from its origin, A, to the point of intersection the trajectory, C, and the superior nappe is the part, CB, from the intersection of the trajectory, C, to the extremity, B, which limits the effective part of the sheaf. (See Figure 1.)

We have from the figure the following:

$\frac{EA}{C} = \frac{AC}{½\ O'}$ C and O being measured in mils.

Replacing EA by E'A, to which it is practically equal, we have E'A = $\frac{AC}{½\ O}$ AC.s

It has previously stated that up to about 4000 meters ½ angle O is greater than angle C, consequently up to that range AC is greater than E'A.

$$E'A = E'C — AC, \text{ or } AC = \frac{E'C}{1 + \frac{C}{½\ O.}}$$

The following table gives the different values of E'A and of AC. for different ranges and for different heights of burst:

Ranges in meters.	Height of bursts									
	1 mil		2 mils		3 mils		4 mils		5 mils	
	E'A	AC	E'A	AC	E'A	AC	E'A	AC	E'A	AC
1.000	7.6	42.4	15.2	84.8	22.8	127.2	30.4	169.6	38	212
2.000	9.4	23.9	18.8	47.8	28.2	71.7	37.6	95.6	47	119.5
2.500	10	18.6		37.2	30	55.8	40	74.4	50	93
3.000	10.1	14.9	20.2	29.8	30.3	44.7	40.4	59.6	50.5	74.5
4.000	9.9	10.1	19.8	20.2	29.7	30.3	39.6	40.4	49.5	50.5
5.000	9.6	7	19.2	14	28.8	21	38.4	28	48	35

The target, figure 2, although hidden by the burst at E, may really be between E' and A. In this case the range which is sensed short is in reality long as far as any effective shrapnel bursting at E is concerned.

It seems, then, that if the fire for effect is begun at the point E, the target will not be hit at all. This would be absolutely true were

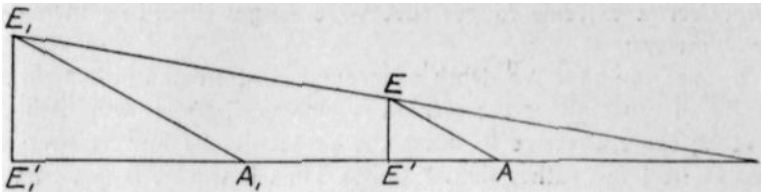

FIG. 2.

there no variation in the point of burst, and if in passing to the fire for effect the shrapnel were burst at the same height as in adjustment.

In passing to fire for effect at ranges less than 4,000 meters, the height of burst is raised above that used in fire for adjustment. Suppose it were burst at E_1 such that E_1 E'_1 is equal to 2 EE', then A_1C = 2 AC.

Now, as we have seen that up to 4000 meters, A'C is greater than E'A, then for ranges not exceeding that distance the point A, which is the origin of the intersection of the sheaf by the ground, is surely between E' and C; that is, the target is now surely covered by part of the sheaf. As the height of burst for adjustment is one mil, in order to cover the target it will be sufficient in passing to fire for effect to raise the height of burst one mil. If raised to two mils it will more effectively cover the target.

Knowing E' A and E' B (figure 1), which latter is the distance at which the balls ceased to be effective, the values of AB are determined and tabulated as follows:

Ranges in meters.	Height of bursts above ground				
	1 mil	2 mils	3 mils	4 mils	5 mils
1,000	207.4	199.8	192.2	184.6	117
2,000	175.6	166.2	156.8	147.4	138
2,500	165	155	145	135	125
3,000	154.9	144.8	134.7	124.6	114.5
4,000	145.1	135.2	125.3	115.4	105.5
5,000	140.4	130.8	121.2	111.6	102

This table shows, first: That the effective depth of the sheaf diminishes as the range increases. At extreme ranges the distance effectively beaten is not much greater than 100 meters, consquently, in a fire for effect at successive ranges differing by 100 meters, the sheafs will not effectively cover the ground swept. So, in order to be sure that no part of the terrain is not effectively covered, in fire

for effect at extreme ranges successive ranges should be increased by 50 meters.

2. That the effective depth of ground covered diminishes as the height of burst above the ground is increased, and it would therefore be more effective to burst the projectiles as low as possible, that is, at 1 mil rather than 3 mils. This, however, is not true in reality, for the effective length of ground covered depends largely upon the danger space which, in turn, depends upon the angle of fall.

Knowing AB and AC, the values of CB are given in the following table:

Ranges in meters.	Height of bursts above ground				
	1 mil	2 mils	3 mils	4 mils	5 mils
1.000	165	115	65	15	
2.000	151.7	118.4	85.1	51.8	18.5
2.500	146.4	117.8	89.2	60.6	32
3.000	140	115	90	65	40
4.000	135	115	95	75	55
5.000	133.4	116.8	100.2	83.6	67

This table shows that for a height of burst of 3 mils, the depth of the superior nappe is less than 100 meters. Hence, when the target is in the 200-yard bracket, the two salvos fired at the short limit of the bracket diminished by 100 meters, will probably have no effect upon the target.*

The Number of Effective Balls in the Sheaf.

In the following discussion it is assumed that the balls are uniformly distributed in the cone of revolution AES (Figure 3), consequently, the inferior nappe AEC will contain 145 balls; the other half of the cone contains 145 balls, of which only a certain number are effective. This number of effective balls is included in the superior nappe CEB.

At the point of fall, C, pass a plane perpendicular to the axis of revolution of the cone and divide this right section into ten zones, each equal in width to 1/5 of the radius, CS. Since we have assumed that the balls are uniformly distributed in the cone, each of

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* The figures given in the above table do not agree with the experiments conducted at Fort Riley, which give to CB a much greater length. Any deduction drawn from the use of the above table or from the use of the table based on the Fort Riley experiments would be practically similar, as the density of the hits in the part of the sheaf farthest from the point of burst is very low.

these zones will contain a number of the total balls which is proportional to the surface of the zone considered. These numbers are shown in the following figure:

Moreover, if we calculate the surface of the zone of the right section

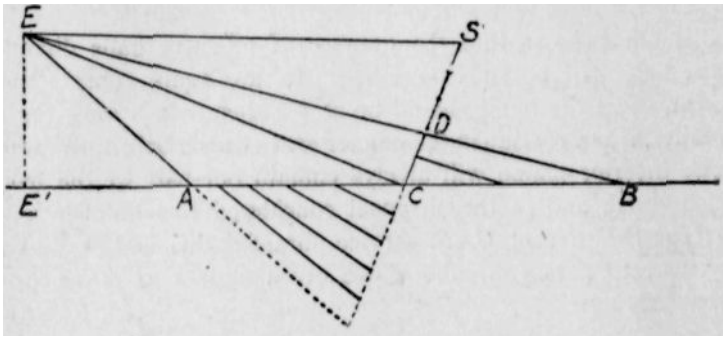


FIG. 3.

limited by CD (Figure 3), the number of balls in this section can be found. That is to say, that a number of balls in the superior nappe can be approximately determined by comparing the surface of the zone CD with the surface of the zones it covers.

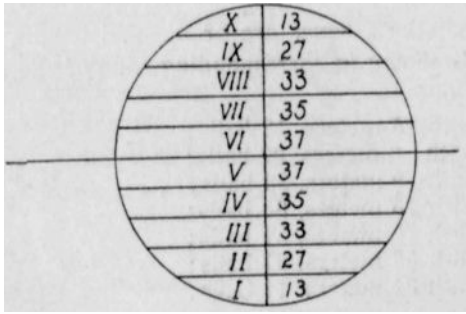


FIG. 4.

The following table shows the number of balls in each of these zones when the shrapnel are burst at different heights above the ground for the different ranges:

Ranges in meters.	Height of burst above ground in mils				
	1	2	3	4	5
1.000	23	16	9	2	
2.000	60	48	35	21	8
2.500	83	68	52	35	18
3.000	109	89	71	51	32
4.000	140	131	115	92	70
5.000	145	145	140	130	115

This table shows that the number of effective balls diminishes as the height of burst is increased. It thus again appears that in fire for effect the burst should be at 1 rather than 3 mils, but this, in reality, is not so, due to the danger space of the balls.

The inferior nappe will always contain one-half of the balls in the shrapnel, and in the shrapnel considered this number will be 145; for the present U. S. service shrapnel this is 126, and it is very easy to pass from the above given figures to those for our present shrapnel.

Distribution of the Shrapnel Balls Over the Surface Beaten.

If the 10 zones of the right section previously discussed are projected upon the ground, these equal zones of the right section will give us zones of very unequal length upon the ground. Figure 5 shows the intersection of the sheaf by the ground at a range of 2500 meters and a height of burst of 3 mils.

It is seen that these zones are of unequal length, but contain a number of balls shown in corresponding zone of the right section.

1st zone, width 5 meters, 13 balls;
2nd zone, width 6 meters, 27 balls;
3rd zone, width 9 meters, 33 balls;
4th zone, width 15 meters, 35 balls;
5th zone, width 22 meters, 37 balls;
6th zone, width 58 meters, 37 balls;
7th zone, width 31 meters, 12 balls.

The figure also shows that the mean width of each zone increases as its distance increases from the point of burst.

Knowing the depth and the mean width of the sheaf on the ground, it is easy to calculate the surface of the superior nappe for a burst of three mils above the ground. This surface is about:

3000 square meters for a range of 1000 meters;
3700 square meters for a range of 2000 meters;
3800 square meters for ranges greater than 2000 meters.

Knowing the number of balls in the superior nappe and the surface of these nappes, the following results are arrived at:

At range of 1000 meters, 1 ball for 333 square meters;
At range of 2000 meters, 1 ball for 105 square meters;
At range of 2500 meters, 1 ball for 73 square meters;
At range of 3000 meters, 1 ball for 53 square meters;
At range of 4000 meters, 1 ball for 33 square meters.

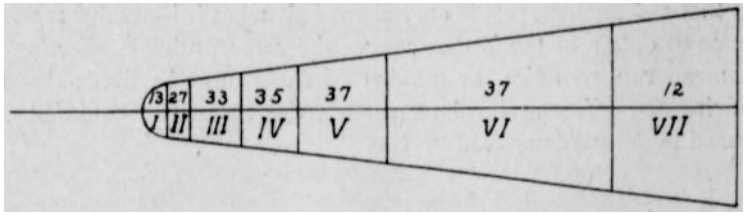


FIG. 5.

Although this shows that the density of balls increases as the range increases, it does not at all follow that the effectiveness of the fire has increased accordingly, for at the short ranges the balls are passing nearly horizontally and at short distances above the ground, consequently the surface covered by them is very much more dangerous than the same surface would be when covered by a greater number of balls falling with greater angles of fall.

The Danger Zone of the Sheaf.

For a ball having a trajectory BC (Figure 6), the danger zone of a man whose height is AB, is the distance AC. Either in front or in rear of AC, this ball, if having a larger angle of fall, will not be dangerous to a man in front of A.

The effectiveness of the sheaf, then, depends upon the total of the danger zones of the balls having sufficient velocity to place a man *hors de combat*. This mean dangerous zone of the sheaf is less than the total of the intersection of the sheaf by the ground.

The following table gives, approximately, what it is at a range of 2500 meters and at 5000 meters:

Height of burst above ground.	Mean dangerous surface for 1 shot			
	2.500 meters.		5.000 meters.	
1 mil	380 Sq.	Meters	200 Sq.	Meters
2 mils	510	—	250	—
3 —	570	—	280	—
4 —	560	—	310	—
5 —	510	—	310	—
6 —	440	—	290	—
9 —	260	—	200	—
12 —	120	—	95	—
15 —	35	—	20	—

This table shows that the mean dangerous surface and consequently the effectiveness of the sheaf diminishes with the distance, and that at 5000 meters it is only about half what it is at 2500 meters. Hence to obtain at the longer ranges the same probable effect as at the mean ranges, twice the number of shots must be fired; that is, in firing for effect at the long ranges, the elevation should be increased by 50 yards instead of 100.

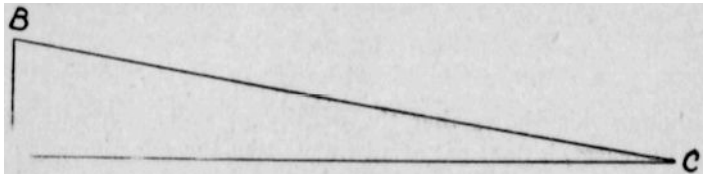


FIG. 6.

If a large number of shrapnel are fired at any range under similar conditions, and the probable error of the height of burst determined and called E, the probable error of height of burst of other series, fired under conditions similar to the first should also be E.

If the adjustment is such that the mean height of burst is b mils, then in any series the most frequent position of the height of burst should be b mils, and the most frequent position of 50% of the heights of burst of any series will be within E mils, of the mean height, b mils, 82% within 2 E mils, and 96% within 3 E mils of the mean height, b mils, and 100% within 4 E mils of this mean height of burst.

If we consider a series of 1000 shots with the mean height of

burst at 3 mils and a probable error of height of burst of 1 mil, then

250 should burst between 3 and 2 mils.
250 should burst between 3 and 4 mils.
160 should burst between 2 and 1 mils.
160 should burst between 4 and 5 mils.
70 should burst between 1 and 0 mils.
70 should burst between 5 and 6 mils.
20 should burst between 6 and 7 mils.
20 should burst between on graze

As the mean effect most often obtained by firing 250 series of 4 rounds each, or 500 series of 2 rounds each, will be approximately the mean obtained by one series of 1000 rounds fired under similar conditions, we can say that the mean effect most often obtained in any series of a small number of shrapnel will be the mean effect obtained in firing a great number.

If the probable error in height of burst is 1 mil, then the probable error in range of burst, B, will be 1 mil multiplied by the range expressed in thousands, divided by the slope of fall. At 2500 yards, for the U S. field gun, the slope of fall is approximately 1 on 10, therefore B = 2.5 divided by 1/10 = 25 yards.

Draw a vertical line at any point 2500 yards from gun and call this the mean range to target, and suppose the mean height of burst to be at 3 mils or 7.5 yards from the line joining gun and target on this vertical line. As, under the assumption made, B equals 25 yards, 25 per cent of all bursts will occur between vertical planes through the target and a point 25 yards beyond, 16 per cent between the planes 25 and 50 yards beyond the target, and one-half of the total number, or all beyond the target, will be within the planes through the target and 100 yards beyond; and so for all bursts short of the target plane. If the mean point of burst is located in the horizontal plane 3 mils (7.5 yards) above the target, then 25 per cent of all bursts will occur between planes 3 and 4 mils high, 16 per cent between 4 and 5 mils, and 50 per cent of the whole number, or all of those above the mean plane of burst will be included within the horizontal planes 3 and 7 mils high. Bursts below the mean plane are symmetrically disposed. Combining the shots which burst beyond or short of the target, contained in any two vertical planes, with those bursting above or below the mean, and contained with two horizontal planes, we obtain the number

that burst with the quadrangle limited by the planes in question; thus 25 per cent by 25 per cent or 6.25 per cent will burst between 3 and 4 mils high and between the vertical plane through the target and one 25 yards beyond; and so for the other heights of burst and distances in front and beyond the target. Hence the following table which gives the number of shrapnel bursting in various rectangles in front and rear of the target and between given heights in mils above the line connecting the gun and target.

TABLE A.

Height of Burst	Intervals of Burst in Yards				
	Between 0 & +25 0 & –25	Between +25 & +50 –25 & –50	Between +50 & +75 –50 & –75	Between +75 & +100 –75 & –100	Total
Between 7 and 6 mils	10	6.4	2.8	.8	20
Between 6 and 5 mils	35	22.4	9.8	2.8	70
Between 5 and 4 mils	80	51.2	22.4	6.4	160
Between 4 and 3 mils	125	80	35	10	250
Between 3 and 2 mils	125	80	35	10	250
Between 2 and 1 mils	80	51.2	22.4	6.4	160
Between 1 and 0 mils	35	22.4	9.8	2.8	70
On graze	10	6.4	2.8	.8	20
Totals	500	320.0	140.0	40.0	1000

The mean effect of these shrapnel will be approximately the effect of shrapnel burst at mean heights, i. e., for the 1,000 shots burst as indicated above we will obtain approximately the same results by the following:

10	burst at 6.5 mils.
45	burst at 6 mils.
115	burst at 5 mils.
205	burst at 4 mils.
250	burst at 3 mils.
205	burst at 2 mils.
115	burst at 1 mil.
35	burst at ½ mil.
20	burst at graze.
1000	

Combining these with table A, we obtain:

Height of Burst	Intervals of Burst				
	± 25	± 50	± 75	± 100	Totals
Mils' 6½	5.	3.2	1.4	.4	10
" 6	22.5	14.4	6.3	1.8	45
" 5	57.5	36.8	16.1	4.6	115
" 4	102.5	65.6	28.7	8.2	205
" 3	125.0	80.0	35.0	10.0	250
" 2	102.5	65.6	28.7	8.2	205
" 1	57.5	36.8	16.1	4.6	115
" ½	17.5	11.2	4.9	1.4	35
Graze	10.	6.4	2.8	.8	20
Totals	500.0	320.0	140.0	40.0	1000

or as the mean effect of these shrapnel will be approximately that of an equal number of shrapnel bursting at certain distances in front and rear of target, we obtain the following table:

TABLE B.

Height of Burst	Intervals of Burst ± 12½	± 25	± 50	± 75	± 87½	Totals
6½ mils	2.5	4.1	2.30	.9	.2	10
6 "	11.25	18.45	10.35	4.05	.9	45
5 "	28.75	47.15	26.45	10.35	2.3	115
4 "	51.25	84.05	47.15	18.45	4.1	205
3 "	62.50	102.50	57.50	22.50	5.0	250
2 "	51.25	84.05	47.15	18.45	4.1	205
1 "	28.75	47.15	26.45	10.35	2.3	115
½ "	8.75	14.35	8.05	3.15	.7	35
Graze	5.0	8.20	4.60	1.8	.4	20
Totals	250.00	410.00	230.00	90.00	20.0	1000

If we know the form of the intersection of the sheaf by horizontal planes for different heights of burst and the distribution of the balls, we can find from table B the number of balls covering each part of the horizontal target.

It is unfortunate that the relative killing effect of the balls in the lower and upper nappes are not known with more certainty. An idea, however, of what can be expected from different methods of fire for effect is obtained by using the most probable sheaf for different heights and interval of burst at the different ranges.

Plate III shows the number of bullets over each 5 yards of ground covered by this sheaf at range of 2500 yards and height of burst of 3 mils, when intervals of burst are as shown by Fig. I.

Plate II does the same for R of 5000 yards and height of burst of 4 mils.

Other combinations can be obtained by assuming other probable heights and intervals of burst.

From table B it is seen that the 10 shrapnel bursting at 6½ mils will have very little relative effect upon the percentages and the 20 shots burst on graze will have almost no effect upon the percentages obtained from a consideration of the other 970 shrapnel. Hence, these shrapnel can be disregarded.

The following table C is therefore made, which, with the effective sheafs for bursts at 3½, 1¾ and 4¾ will give approximately the same relative mean effect as that obtained by using table B, except that the far limits of the lower and upper nappes will be held closer to the targets.

TABLE C.

Height of Burst	Intervals of Burst, Front and Rear of Target ± 12½ yds.	± 25 yds.	± 50 yds.	± 75 yds.	± 87½ yds.
4¾ mils	61.25	100.45	56.35	22.05	4.9
3½ "	121.25	198.85	111.55	43.65	9.7
1¾ "	60.00	98.40	55.20	21.60	4.8
Totals	242.50	397.70	223.10	87.30	19.4
Graze and 6½ mils	7.50	12.30	6.90	2.70	.6

Diagrams are appended showing the following data:

Plate I.

(a) The arrangement of the targets in the tests conducted at Fort Riley in 1906.
(b) The pattern on the ground of the shrapnel balls at a range of 2800 yards and height of burst of 3 mils, as determined in the Fort Riley tests.
(c) The distribution and density of hits in the Fort Riley tests.

Plate II.

(a) Normal distribution to be expected from a salvo of 8 shots at a range of 5,000 yards.
(b) Vertical section of the cone of distribution at this range.
(c) The pattern on the ground of the shrapnel balls with the distribution for each 5 yards.
(d) The distribution of the shrapnel balls for the 8 shots of the salvo mentioned in (a).
(e) The distribution of the shrapnel balls when 8 shots are fired at ranges of 5,000, 5,050, and 5,100 yards.
(f) The distribution of the shrapnel balls for 8 shots fired at ranges 4,900, 5,000, and 5,100 yards.

Plate III.

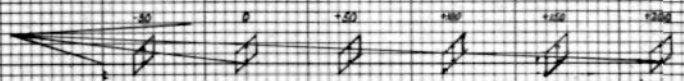
Same data as Plate II for a range of 2,500 yards.

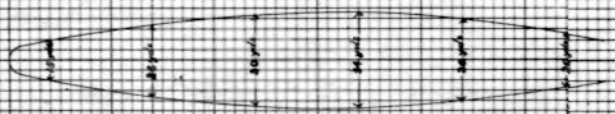
Plate IV.

Section and plan of the cone of dispersion for different heights of burst, range 3000 yards (British 15 pound shrapnel).

Plate V.

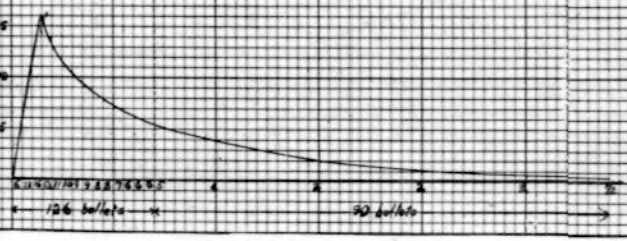
Section and plan of the cone of dispersion for different heights of burst, range 3000 yards (French 15.92 pound shrapnel).





Density of hits	53	64	43	24	16	
Number of hits on target 1 yard high	8	17	13	8	4	2

Curve showing distribution of bullets over each 5 yard zone—
252 bullets in shrapnel.
126 in interior happe.
90 effective in superior happe.



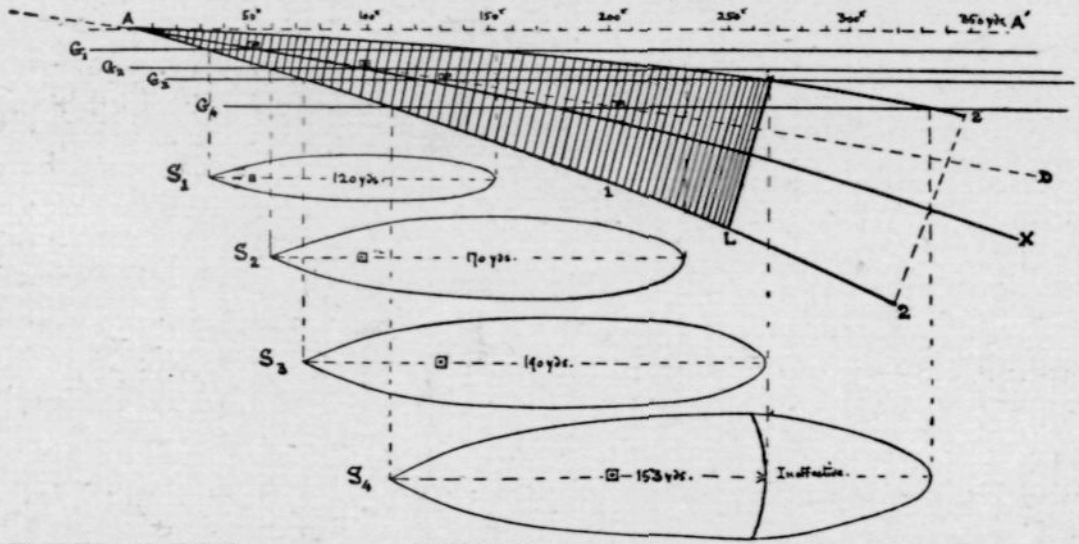
Targets were 6 feet high placed at distance of 50 yards apart
Following shows number of hits on each target.
-50 = 16
0 = 34
+50 = 32
+100 = 16
+150 = 8
+200 = 16

Range 2800 yards.

25 Shrapnel fired - 5 burst on graze and 20 in air. The mean height of burst was 49 miles in distant fire but reduced to 42.3 mile height which gave the figures used in this drawing.
Angle of opening not given.
It was assumed in drawing as 16°.

PLATE IV

Reproduced from 'Modern Guns and Gunnery' by Col. H.A. Bethel, R.F.A.



EXPLANATION OF FIGURE. **DIAGRAM A.**—

The upper figure represents the cone of bullets of the 15 pr. B.L. shrapnel at a range of 3000 yards, seen from the side of the range.

AA' is a horizontal line. A 1-1 is the cone up to the end of first second. A 2-2 the cone up to the end of the next second. LL is the limit of effective velocity, beyond which the bullets are harmless.

AX is the path of the central bullet of the cone.

AD is the prolongation of the trajectory of the shell before bursting, descending at an angle of 1 in 6½.

G_1 is the ground surface drawn $\frac{1}{1000}$ or 27 feet below A, the point of burst; G_2 is the ground surface drawn 50 feet below A; G_3 is 65 feet below A, at the limit at which all bullets are still effective; G_4 is 100 feet below A.

S_1 S_2 S_3 S_4 represent in plan the beaten ground corresponding to each of the above heights of burst; that is, the section of the cone by the surface of the ground.

15 PR. B.L. SHRAPNEL.

FIG. 1

FIG. 2

5000 YDS RANGE

FIG. 3

TABLE A

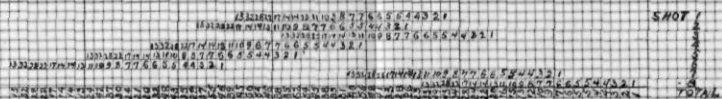


TABLE B

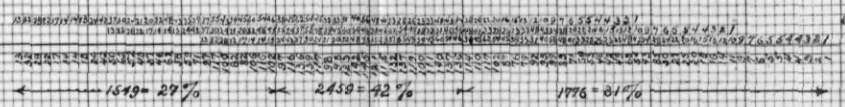


TABLE C

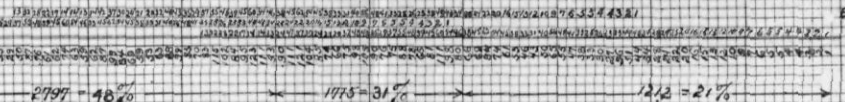


FIG 1- SHOWS NORMAL DISTRIBUTION TO BE EXPECTED FROM A SALVO OF 8 SHOTS AT 5000 YDS RANGE.
FIG 2- SHOWS VERTICAL SECTION OF CONE OF DISPERSION FOR A SHRAPNEL BURST AT A HEIGHT OF 4 MILES
FIG 3- SHOWS DISTRIBUTION OF BALLS FOR EACH FIVE YARDS AT 5000 YARDS RANGE.
TABLE-A- SHOWS DISTRIBUTION OF BALLS FOR THE EIGHT SHOTS SHOWN IN FIG 1.
TABLE-B- SHOWS DISTRIBUTION OF BALLS FOR EIGHT SHOTS EACH AT 5000 YDS, 5050 YDS. AND 5100 YDS.
TABLE-C- SHOWS DISTRIBUTION OF BALLS FOR EIGHT SHOTS EACH AT 4950 YDS, 5000 YDS. AND 5100 YDS.

9/29/13
H.J.S.
D.A.S.

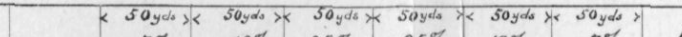


FIG. 1

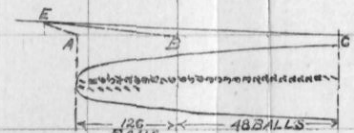


FIG. 2

FIG. 3

2500 YDS RANGE.

TABLE A

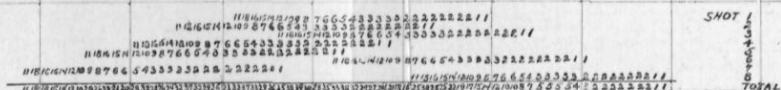
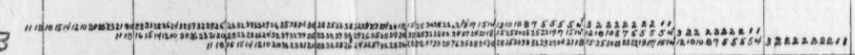
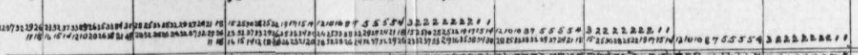


TABLE B



1523 = 36.6% 1688 = 40.4% 965 = 23.1%

TABLE C



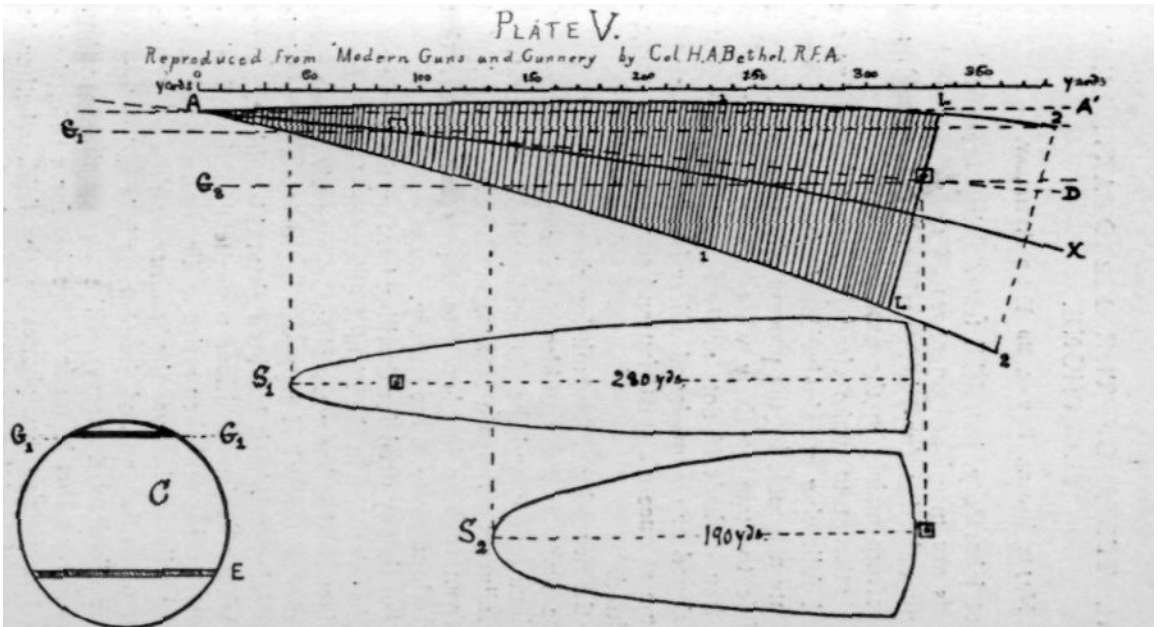
2325 = 55.7% 1186 = 28.4% 665 = 15.9%

FIG. 1 - SHOWS NORMAL DISTRIBUTION TO BE EXPECTED FROM A SALVO OF 8 SHOTS AT 2500 YDS. RANGE.
FIG. 2 - SHOWS VERTICAL SECTION OF CONE OF DISPERSION FOR A SHRAPNEL BURST AT A HEIGHT OF 3 MILES
FIG. 3 - SHOWS DISTRIBUTION OF BALLS FOR EACH FIVE YARDS AT 2500 YARDS RANGE.
TABLE-A - SHOWS DISTRIBUTION OF BALLS FOR THE EIGHT SHOTS SHOWN IN FIG. 1
TABLE-B - SHOWS DISTRIBUTION OF BALLS FOR EIGHT SHOTS EACH AT 2500 YDS., 2550 YDS. AND 2600 YDS
TABLE-C - SHOWS DISTRIBUTION OF BALLS FOR EIGHT SHOTS EACH AT 2400 YDS, 2500 YDS AND 2600 YDS.

9/29/18
H.J.S
D.A.G.

PLATE V.

Reproduced from 'Modern Guns and Gunnery' by Col H.A.Bethel, R.F.A.



EXPLANATION OF FIGURE. **DIAGRAM B.**—

The upper figure represents the cone of bullets of the French Q.F. field shrapnel at a range of 3000 yards, seen from the side of the range.

AA' is a horizontal line. A 1-1 is the cone up to the end of the first second, A 2-2 is the cone up to the end of the next second. LL is the limit of effective velocity, beyond which the bullets are harmless.

AX is the path of the central bullet of the cone.

AD is the prolongation of the path of the shell before bursting, descending at an angle of 1 in 10.

G^1 is the ground surface drawn $\frac{75}{275}$ or 27 feet below A; G_2 is 100 below A.

$S_1 S_2$ represent in plan the beaten ground corresponding to each of the above heights of burst; that is, the section of the cone by the surface of the ground.

FRENCH SHRAPNEL.

PRACTICAL TESTS OF THE FIELD ARTILLERY TELEPHONE.

BY MAJOR BROOKE PAYNE, 2D FIELD ARTILLERY.

These are not laboratory, but field, tests. They are practically the same tests as are mentioned on pages 24 and 25, "Telephone and Signal Communication for Field Artillery" (Olmstead), and they differ therefrom mainly in the particular that they go more into detail, and attempt to make clear just what operations are to be performed following certain indicated diagnoses. Generally it is easy to locate a trouble by the process of elimination, even if it is not possible to state precisely what the trouble is; but to remedy it is often difficult if not locally impossible. To enable the noncommissioned or commssioned officer in charge of the telephones to become at once diagnostician and surgeon, these suggestions are submitted.

And what is the necessity for submitting them?

First, because many phone troubles are incorrectly diagnosed, harmful operations follow, and the phone instead of the operator is blamed for its failures; and again because much delay and crippled service result from turning in phones to depots for repairs that might easily have been made at the battery.

There seems hardly any need for dwelling here on the importance of an effective phone service in the Field Artillery or the dependence upon this effectiveness that has come about as a result of our modern methods of central control of separated fire units. And yet it is clear that not sufficient emphasis has been given this subject, for we continue to make our field dispositions regardless of the effectiveness of our phone service, and then retire in disgust from the problem that suddenly collapses because the "phones won't work." I do not think it is so often the fault of the phones; it is rather because of some abuse or misdirected energy on the part of the operators.

First, then, let every effort be made to provide for a safe, shockless method of transporting the phones in the field, whether in chests, on pack-mules, saddles, or strapped to the back. Chests should be padded or stuffed, and back-straps should be short and reinforced by body-straps close up under the arm pits. It was not

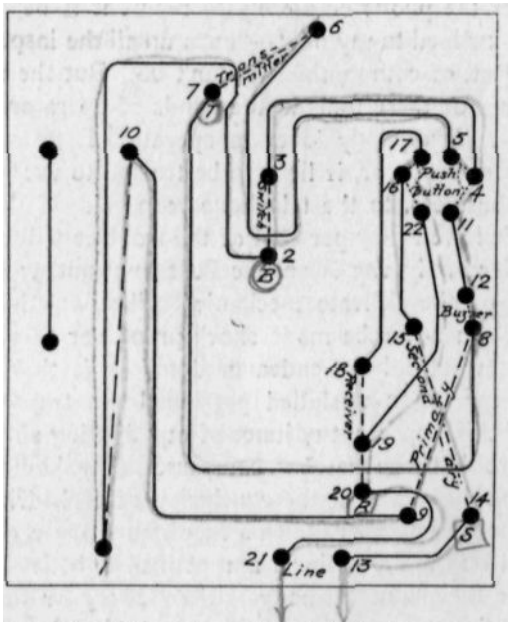
an uncommon sight to see phones violently striking the cantle of the saddle as the carrier goes dashing to the front. This is a ridiculous perversion of service conditions. Every battalion commander should at once set about seeing that the carrier-chests and body transportation of his phones are as carefully and skilfully planned and provided for as the delicacy of the instrument demands and as his ingenuity will suggest. He should then impress upon the personnel attached to the phone service that it is a criminal offense to tinker with the instrument, to take it apart, or to attempt to beat it or shake it into submissiveness; that the only duty of the operator is to speak over the phone or merely to report it if he is not able to do so. I am inclined to say next—"burn up all the inspector's pocket tool-kits." But, of course, this wouldn't do. But the mere promiscuous presence of these tools in the hands of operators is a menace to the phone. Everybody loves to operate. Issue one set to the reconnaissance officer, or, if he is to be trusted to use judgment and skill in this business, to the telephone corporal. If these two suggestions be followed fifty per cent of the troubles will be eliminated.

The phone now in use is an excellent instrument; but from the very nature of the delicate mechanical vibrations involved in its operation, it can never be made shock-proof nor "fool-proof." In other words, what I have endeavored to say is that we have entrusted too far to an unskilled personnel the transportation and operation of this important adjunct of our fighting ability. General orders require that stop watches, compasses, etc., should be turned in to the responsible officer at the conclusion of each drill or exercise. How much more important is this requirement as regards the telephone. And on the firing line I am inclined to believe that the best man to wear the phone on body is the Battery or Battalion Commander. In this way messages will not require the two customary "translations," and the officers executing the problem can speak directly to each other in terms that will be easily comprehended and promptly transmitted.

The Tests.

First improvise a "testing-set," made by connecting a receiver in series with one of the dry-cell elements issued with the phone. To do this there is required one receiver, about one yard of twisted-insulated-pair wire, one of the cells taken from the dry battery issued,

and a small quantity of insulating tape. Cut one strand of the double wire about half way down its length and insert the cell, properly connected in series, binding the parts together with the splicing tape. The wire ends may be soldered to the cell if you care to take the trouble. If you can get a receiver from some phone that is not going to be used—some old instrument, say, that is on hand in the Post Signal office—you will be saved the necessity of using a receiver that is likely to be needed in service. This receiver should be of the "head" type, capable of being permanently strapped into place over the ear.



The two free ends of the piece of twisted wire are now untwisted, cleaned of insulation and corrosion and are ready for use. This set is most convenient in testing the circuits of the phone through any of its parts—transmitter, receiver, connections, etc.—and should be carried into the field by the signal corporal or reconnaissance officer. It can be made very compact. In any form it is indispensable to a thorough test of the phone. To facilitate the descriptions the following diagram is submitted. It represents the appearance of the connections on the reverse side of the "base plate." Study this diagram in connection with the one placed in the telephone case, and

identify the circuits in the two illustrations; the numbered points may be easily duplicated on the latter drawing.

The Battery.—If there are means at the post for testing the voltage of the batteries on hand their strength can thus be directly measured; it should be about 4½ volts per battery. In this battalion an inexpensive pocket ammeter* is used to determine this matter. The batteries that were first sent to the Philippines were over a year old; very poor results were obtained, if any. Then came a lot about 5 months old which proved very satisfactory. The battery test given on the card in the phone case is not conclusive, as the connections between B and T involve at least six binding screws, and it depends on the perfection of these intermediate connections. This fact should be considered if the B—T test fails, and the battery poles should be tested directly by means of wire, or other metal, in order to determine the existence of the spark.

Examine the contact between the two elements of the battery by removing them from their cylindrical paper case.

The speaking circuit should be tested next. It usually happens that the making of a test follows the appearance of some trouble. It should precede it and thus diminish the chance of its appearance. It accordingly happens that the first test a phone usually receives is the practical working it gets on some field line. This is certainly a fair test, but it is rather a late time to make it. The speaking circuits should be tested on all phones before starting out on any exercise that may involve their use, and in ample time to make corrections.

With a good battery in the phone, insert the jack plug in its socket, connect the two free ends of the plug cord, put the receiver to the ear, turn the transmitter to speaking position, and blow, whistle, or tap at transmitter. It should be sharply and distinctly heard, so that (continuing to blow, whistle, etc.) if the jack plug be removed there is a marked access of silence as the connection at the plug is broken. This test should result, as stated, in a sharp response. Drawing the edge of any metal instrument along the transmitter arms should resound in the receiver almost disagreeably sharp.

If you care to push this test a little further, disconnect the two free ends of the plug cord, insert a second good receiver in the circuit at that point and see if an assistant can hear therein the sharp noises.

---

*It would pay a battery commander to buy a pocket ammeter. The one I mentioned above cost two dollars, gold, in Manila.

If the test fails the trouble can lie in the transmitter, in the receiver, or in the connections. It has often been laid to the transmitter because the connections could not be carefully tested out and the receiver test is simple. But this assignment of the fault to the transmitter is most often erroneous. The transmitter in this phone is stronger, more compact and less liable to injury than in any other phone in general service. The only failure of function to which it is liable is due to unskillful attempts to adjust it. The receiver is likewise well and strongly constructed. Failure of the speaking circuit test will probably be due, therefore, to defects in the connections.

To test the receiver remove it, with its cords, from the phone, place it to the ear and touch the free ends of the cords to the opposite poles of a good battery. "A sharp click should be heard if the receiver is operative." This test is precisely the same as given on the card. If the receiver is in order, replace it in the phone and next examine the transmitter. If the receiver is out of order, examine it for interfering screws, loose screws, foreign particles, loss of insulation, broken wiring, etc. These defects can be easily remedied at the post unless the broken wire is in the coil, in which case the receiver should be turned in to the depot for exchange or repair.

To test the transmitter remove the battery from the phone, turn up the transmitter to the speaking position, *which should always be vertical*, place the "testing set" on the head and apply the two free wire ends of this set to the two points 6 and 7. If an irregular but continuous sound is heard, like the rushing of wind through a pipe, the transmitter is probably in order. Whistle, blow or tap at the transmitter, and it should be sharply heard, and sharply broken when the connection is broken. If, however, a sharp click is heard in the receiver on making contact, the transmitter is short-circuited; if no sound is heard it is open-circuited. The resulting inspection of the transmitter should be most carefully made, aided by a magnifying glass. Loose or absent screws, defective insulation, broken wire or the presence of foreign particles may be discovered and corrected. The diaphragm may have been screwed up too tight; this may be corrected if done by someone with a knowledge of delicate repair work and with proper tools. But if none of these defects exists or if after these defects are removed the transmitter still appears

out of order, turn it in to the depot for repairs or ask for a new one. But, as stated above, most of the troubles occur not in the transmitter or receiver but in the various connections, switches, binding posts, contacts, etc.

To test connections remove telephone base-plate from the case, remove the battery and, with the "testing set" on the head, proceed to examine the circuits in detail.

For the sake of convenience, the connections on the back of this base-plate and shown in the accompanying diagram may be divided into the "primary circuit" and the "secondary circuit."

The *primary circuit* runs as follows, beginning on one side of the battery, 1-2-3-4-5-6-7-8-9-10, ending on the opposite side of the battery.

At 4 it branches into the transmitter circuit on one side of the push button, and into the vibrator (buzzer) circuit on the other.

The *secondary circuit* runs as follows, beginning at one side of the line, 13-14-15-16-17-18-19-20-21, and ending at the opposite side of the line.

At 16 it branches into the receiver circuit on one side of the push button, and into a cut-out circuit on the other side that merely eliminates the receiver. To understand this double throw of the push-button do not hesitate to at once remove the metal covers over the button and inspect its operation.

With the testing set in place on the head, and transmitter up as described above, hold one end of the testing wire at 1 and advance with the other end of the wire to each binding post of the primary circuit in turn, proceeding in the normal sequence of the cardinal numbers until you reach 10. At each step a distinct click will be heard in the receiver, and after reaching 7 the characteristic transmitter sound will be noticed.

In a similar way the secondary circuit may be tested, placing one wire at 13 and advancing in normal numerical sequence to 21.

The two branch circuits at 4 and 16 should then be tested.

And so may the connection between any two binding posts be tested at will.

It is not probable that these copper strips will become broken. In case of failure to get contact where it should exist, there are two causes suggested—air space or corrosion under screw taps. Remove the tap and examine to see if some intervening shoulder of the hard

rubber base-plate is not preventing the tap from being screwed home against the copper strip. Or, if it is a case of corrosion, simply tightening the binding screw is generally sufficient to restore contact. Sometimes air spaces have to be remedied by a little solder.

The Push Button.—The push button is a sort of double-throw switch. Remove the metal housings, both the outer and inner ones (four screws in all). Pushing the button throws the two contacts at 5 and 17 down to 11 and 22, respectively.

A good many troubles have been located in this button due to the flat springs in the switches having become bent out of shape and thus establishing wrong contacts. Get the switches in the best light possible and study them; the two sides, separated by a rubber slab which is held in place by friction only, are made up of three flat strips each. On either side of this combination, the two upper strips should always be in contact—and *clean* contact; the lower strips should be free of each other. When the button is pushed, the contact should be broken between the two upper strips and made between the two lower ones. If this is not the case, examine to see where bending is needed, then remove the strips and carefully bend the proper one—a little at a time.

The Buzzer.—The laminated core through the induction coil is a permanent magnet, and the passage of the current through the primary coil further magnetizes this core. Look at figure 5, page 14, "*Telephone and Signal Communication for Field Artillery*." The screws on the extreme left of the figure are the adjusting screws; those on the right are the clamp screws. In the following description "upper" and "lower" will refer to these relations as viewed in figure 5.

If the buzzer fails to operate, get the phone in a good light. Unscrew the lower adjusting screw so as to be clear of the flat spring. Then unscrew the upper clamp screw so as to allow free motion in its adjusting screw. Next operate upper adjusting screw until the flat spring is about 1/20 inch clear of the coreend; then screw in lower adjusting screw until it touches the flat spring. With a battery in the phone and transmitter up, push the button; if the buzzer works, hold hard to the upper and lower adjusting screws and (without tools) set up tight the clamp screws, and try the button again. If the buzzer still fails to operate, diminish the air space between flat spring and core, and repeat other adjustments.

Placing a white card behind spring will facilitate seeing the extent of air space. It sometimes happens that there is a spark across from the coil to the top bar, through the black paper envelope. This is due to dampness. It may be remedied by baking the coil in a "slow" oven and then shellacing the coil, after which it should be again baked. This process had better not be undertaken in the battery unless it is a case of urgency. In the foregoing adjustment of the buzzer it should be remembered that clean contacts are necessary and that the intensity of the buzz depends on the strength of the battery.

I was afforded an opportunity to inspect several of the phones turned into the Manila depot for repairs and found that every one of them, with one exception, could easily have been repaired at the battery. Indeed what they required were adjustments rather than repairs; and in almost every case the trouble lay in the connections, contacts or switches. In a few cases there were evidences of ignorant tampering. And so I repeat that if these foregoing suggestions be followed, much delay and disabled service will be avoided, a result which will be most gratifying to battery officers as well as to the Signal Corps officers in charge of the depots.

FIELD SERVICE AND DRILL REGULATIONS—A CRITICISM AND A SUGGESTION.

BY MAJOR DWIGHT E. AULTMAN, 1ST FIELD ARTILLERY.

Before me on my table lie four books, four little volumes of paramount importance to the service. We are all interested in these little volumes, so let us give them more than a cursory glance.

The first to attract the eye is a gaudy yellow block, too thick to be carried in the pocket, where one would like to stow a small book with which one is extremely intimate, too small to find its proper place on a bookshelf. Manifestly an uncomfortable little book, belonging nowhere, and consequently read only because some of its contents are essential to its owner. On opening it, the reason for its size becomes quickly apparent. We find thick paper, widely spaced type, wide margins. Naturally such a book will have many pages, and be thick and cumbersome.

The red book next attracts the eye. A little thinner, but larger in its other dimensions, it looks more like a book, though too small for the library shelves and too large for the pockets. Its four hundred and twelve pages are in somewhat better form, with thinner paper, closer spacing, and better margins.

The thinner blue book has fewer pages, but is identical with the red book in paper, type and margins.

Finally, as a climax, or anti-climax, the modest little black tome is the nearest of them all to an ideal pocket volume.

Is this system? These four volumes, containing the epitome of a soldier's profession, and which all officers are supposed to have and to study, differ from one another in almost every physical characteristic. Why could they not be made reasonably similar, so that they might form an attractive set for an officer's desk, or be carried with him in a neat traveling case? Is not their outward dissimilarity an index to the unharmonized character of their contents? Let us see!

It is not intended to enter upon an exhaustive, detailed criticism of the text contained between the covers of these books. The reader would tire of it long before the writer, and would probably

quit right here. Besides, the criticisms, being in many cases matters of opinion, might not always be pertinent.

However, a careful reading of each text brings the average reader to certain natural conclusions, especially if he is at all inclined to make comparisons. Most of you who take the trouble to read this brief article, have no doubt arrived at part, if not all, of these conclusions.

1. There is a lack of agreement and coordination among the drill regulations of the several arms. This manifests itself in slightly different commands intended to accomplish practically the same object, and in different treatment of the same subject matter. It would seem that the system and order which should be the salient characteristics of a well-organized army, would exact the utmost practicable uniformity in that most important of all military duties, the preparation for combat.

2. Many subjects are duplicated in the several drill regulations. Such, for example, are the School of the Soldier, Dismounted; General Rules for Ceremonies, and Trumpet and Bugle Calls. Why could not these appear once, and not require reprinting in all the manuals?

3. None of the drill regulations are thoroughly coordinated with the Field Service Regulations. All of them contain matter which is later treated in F. S. R., and some include definitions and rules, which, if not in conflict with the field service prescriptions, at least give an entirely distinct idea of the subject treated. I open the Cavalry Drill Regulations at random, and find the subject of outposts on page 354, section 867. Compare this with page 76, sections 123, 124 and 125, Field Service Regulations.

4. There are redundancies and repetitions in all the drill regulations. For example, the same statement is made in sections 773 and 776, Field Artillery Drill Regulations, on pages 262 and 263, facing each other. This is another random shot. There are many similar cases.

These conclusions lead us to the remedy, but before seeking it let us see what should be the general principles on which an orderly and uniform system of drill and service regulations should be based. They would appear to be as follows:

1. Each arm should have its own manual, containing all that properly belongs to that arm, and is not common to all the services. Simplicity and practicability should be sought in all cases.

2. Matter not properly belonging to the drill regulations should be excluded. Horseshoeing has no more place in the drill manuals of the mounted service than has the weaving of cotton bandages

in a work on surgery. Such matter properly belongs in other manuals.

3. All that which is common to all arms should be contained in a separate manual for all the services. With regard to matter of this kind, much that is now included in the several drill regulations could be embodied in the Field Service Regulations, and the name of the latter could be changed to "Service Regulations." The word "Field" is not essential.

4. All drill regulations should be thoroughly coordinated with each other, as to subject matter and treatment thereof.

5. The drill regulations of each arm should lead up to and be thoroughly coordinated with the Field Service Regulations. All repetitions and contradictions should be avoided.

6. All such works should be completely indexed for ready reference.

Now, to the remedy. We have, or have had, a drill regulations board in each arm, each board acting independently of the others, and the General Staff has been charged with the preparation of the Field Service Regulations.

There has therefore been no cooperation in the preparation of the different regulations, nor could there be under the circumstances. Lack of harmony among them is therefore nturally to be expected.

Such regulations should all be prepared by a single board, which should include a suitable number of officers of each arm of the service. The members should be selected for their practical character and progressive ideas. Sub-committees composed of the members from each arm of the service should prepare the drill regulations for that arm, having in view the general requirements given above. This would mean, in the present day, merely a thorough revision, as all our drill regulations have been modernized to meet present conditions of armament and tactics. Certain points are still under discussion regarding the latter, but these must be settled some day by the adoption of a definite policy, and the standardization of drill affords an opportunity of forcing such matters to a final conclusion. The work of these sub-committees should be carefully edited by the other members of the board, and their suggestions and criticisms acted upon by the entire board, so as to eliminate all that is not in harmony with the general scheme.

Such drill regulations should then be complete, but before final adoption should be thoroughly demonstrated, and shown to be practical, and in conformity with modern armament and tactics.

Upon the whole board would then fall the crowning work of the

preparation of the Service Regulations, the culmination up to which all others lead.

Nothing further need be said, save that, throughout the work, the suggestions of the ingenious outside may frequently be of value, and such suggestions should be invited and considered. They will frequently untie some pretty hard knots.

Work of this kind is eminently the province of the General Staff, and it seems to the writer that in few ways could its members be better employed.

It should be done, and should be done now. Organization, especially in its relation to promotion, has recently seriously occupied the time of many of our able General Staff officers. But before we seriously consider reorganization, with its attendant and much coveted promotion, let us seek the highest efficiency in that which has been given us.

I believe that this can be done best by standardizing our instruction, by extending it so as to produce actually, and not nominally, the cooperation and community of interest among the services, which are the *sine qua non* of military efficiency.

Let us begin.

THE ANCIENT COMBAT.

BY COLONEL ARDANT DU PICQ.

Translated from the French by Captain J. W. Kilbreth, Jr., 6th F. A.

TRANSLATOR'S PREFACE.

Of the value of Colonel du Picq's work in the study of the psychology of war and of the soldier, it is unnecessary to speak. The aim of his writings may best be shown by an extract from the "lettre questionnaire" which he sent to all officers of his acquaintance—superiors, equals, or subordinates—*who had seen service*.

* * * * *

It seems as though no one was willing to understand that to know tomorrow, one must know yesterday, and nowhere is yesterday *sincerely* described. It is found only in the memories of those who know how to remember because they have known how to observe, and *they* have never spoken. To one of them I now appeal.

The least detail, observed in the act on the field of battle, is more instructive to me, a soldier, than all the Thierses and Jominis in the world. They write, doubtless, for the chiefs of States and of armies, but they never explain what I want to understand—a battalion, a company, or a squad in action.

Whether dealing with a regiment, a battalion, a company, or a squad, it is interesting to know:—

The dispositions made to receive the enemy, or the order of march to move against him; what happens to these dispositions or to this order of march under the independent or simultaneous influence of accidents of the terrain or the approach of danger.

To know whether this order is changed or maintained on drawing closer to the enemy.

What happens when the zone of artillery fire is reached; the zone of infantry fire.

At what moment or at what range certain dispositions, *spontaneous* or ordered, are made before (or for the purpose of) opening fire, or charging, or doing both.

To know how the action opens, what kind of fire is employed, how the men aim. (This last is judged by the results whenever possible—so many rounds fired, so many men down.)

How the charge is made; at what distance the enemy has fled before it; at what distance it is repulsed by the fire, the firm stand, or such or such movement of the enemy. The cost of the charge. Whatever has been noticed of all these same things on the side of the enemy.

To know the bearing, that is to say the order, disorder, cries, silence, nervousness or coolness of leaders and of soldiers, whether on our side or the enemy's, before, during, and after the charge.

Whether the soldier has been amenable to control throughout the action, and whether he has been controlled, or at what moment he has showed a tendency to leave the ranks, either to remain behind or to dash to the front.

If control has become impossible and lost to the leaders, to know at what moment this control has become lost to the battalion commander; at what moment to the captain, to the chief of section, to the chief of squad; at what moment, in brief (if such a thing has happened) the charge has become nothing but a blind rush, whether to the front or to the rear, carrying leaders and soldiers pell-mell.

To know where and when the halt is made.

Where and when the leaders get the men in hand again.

At what periods before, during, or after the day, the roll of the battalion or of the company has been called—the result of these roll-calls.

To know the number of dead and of wounded on both sides; the character of the wounds; the wounds of officers, of noncommissioned officers, of privates, etc., etc.

All details, in a word, which can throw light on either the material side or the moral side of the engagement and can give us the nearest possible view of it, are infinitely more instructive to us, soldiers, than all imaginable discussions about the plans and strategy of the greatest generals, or about their grand tactics on the field of battle.

From colonel to rifleman, we are soldiers, not generals, and we want to know our trade.

Of course, one cannot obtain all possible details of any given action. But, from a series of honest reports, one should certainly be able to pick out a mass of characteristic details, well suited to show us in a striking and irrefutable manner what *must*, of necessity, happen at such or such moment in a battle—to show us the limits of what we can require the soldier, *however good he may be*—to serve, consequently, as the basis for a rational method of fighting—and a *priori* to put us on guard against methods, the pedantic methods of the school.

Every man who has seen anything of war has made for himself a method founded on his own knowledge and his personal experience as a soldier. But experience is long and life is short. The experience of one man can only be completed by that of others.

And that is the reason, General, I dare address myself to yours.

* * * * *

The results of this "enquête sur le combat" are a series of studies on infantry fire and other subjects, written in 1865; "Le combat antique," published in 1868; and "Le combat moderne," never completed.

His death occurred when the last was but a mass of manuscript notes, some developed into chapters, some mere fragments.

Colonel du Picq took part in the Crimean war, transferred at his own request to a regiment ordered to the front, and was captured at Sebastopol in the assault on the central bastion on the 8th of September, 1855. He also took part in the Syrian campaigns of 1860-61, the African campaigns of 1864-66, and the beginning of the war of 1870. He died at Metz on the 19th of August, 1870, from wounds received in action at Longeville-lez-Metz four days before.

AUTHOR'S PREFACE.

Battle is the final goal of armies and man is the chief instrument of battle; nothing can be ordered intelligently in an army—constitution, organization, discipline, tactics—all mutually dependent like the fingers of a hand—without an exact knowledge of the chief instrument, of man, and of his moral condition in this definitive moment of battle.

It often happens that those who discuss the art of war, taking the weapon as their point of departure, take it for granted that the man called on to wield this weapon will always make of it the use foreseen and ordered by their rules and precepts. But the fighting man considered as a reasoning being, giving up his mobile and variable nature to transform himself into a passive pawn and to play the part of an abstract unit in the combinations of the battlefield, is the man of theory—not at all the man of reality. This latter is a being of flesh and bone, of body and spirit, and, strong as this spirit often is, it cannot so master the body that there will be no revolt of the flesh and disturbance of the mind in the face of destruction.

The human heart, to use the words of Marshal Saxe, is, therefore, the basis of all things in war; to understand these latter, the former must be studied.

Let us undertake this study, not dealing at first with the modern battle, too complex to be understood at the first glance, but with the battle of ancient times, simpler and, above all, clearer, even though nowhere fully explained.

The centuries have not changed human nature; its passions, its instincts, and, strongest of them all, the instinct of self-preservation,

have manifested themselves in various ways according to the times, the localities, and to the characters and temperaments of the various races. So in our times one can wonder at the coolness of the English, the dash of the French, and that inertia, called tenacity, of the Russians, under pressure of the same danger, the same emotions. But at bottom one always finds the same man; and it is with this man, always the same at bottom, that the experts, the masters, start when they organize and discipline, when they order in all its details a method of fighting, and when they make their general dispositions for battle. This is shown clearly by a careful analysis of the ancient formations and battles.

The purpose of this work leads us to make this analysis, and, by studying these battles, the study of the man will be accomplished.

We shall go back even farther than the battles of ancient history, back to the fights of primitive man. In studying from the days of the savage down to our own times, we shall obtain a better grasp of the subject.

And shall we then know as much as the masters of war? No more so than one knows how to paint after seeing how an artist does his work. But we shall have a better understanding of these experts and of the great examples they have left us.

We shall learn, as they learned, to distrust mathematics and dynamics applied to war; to avoid the illusions of the target-range and of the manoeuvre ground where our experiences are gained with the soldier calm, cool, unexhausted, well-fed, attentive and obedient—in a word, with an intelligent and docile human instrument, and not with that nervous, impressionable, troubled, inattentive, over-excited, uncertain creature, which, from general to private, is the man in the battle. There are exceptions, but they are rare.

They are persistent and tenacious illusions nevertheless, which always reappear the very day after the reality has proved them false, of which the least serious result would be to lead one to order the impossible, were ordering the impossible not a direct blow at discipline, and did it not result in disconcerting leaders and soldiers by unforseen events and by surprise at the contrast between battle and practice in time of peace.

It is true that there are always surprises in battle. But the more an understanding and knowledge of real conditions has governed the training of the combatant, and the wider they have been spread

through his ranks, the fewer surprises there are. Let us study, then, the man in battle, for it is he that is the man of reality.

CHAPTER I.

Man does not go to battle for the sake of fighting, but to gain the victory. He does everything in his power to minimize the former and to assure the latter.

War between savage tribes, among the Arabs even in our times, is a war of ambuscades by small parties of men each one of whom, at the moment of surprise, chooses, not his adversary but his victim, and assassinates him. The weapons are the same on both sides, and the only way to gain the advantage on one's own side is to surprise the other. The man surprised needs a moment to see clearly and to put himself in position for defense; before that moment has passed he is dead or in flight.

An adversary surprised does not defend himself; he tries to escape. Combats with primitive arms—hatchet or knife—face to face and body to body, so terrible between naked or unarmored enemies, are exceedingly rare. They could only occur between enemies mutually surprised, without any chance of safety for either side except in victory. And yet, in case of such a surprise, there is one other chance of safety—that of retreat, of flight by both sides—and this chance is often taken. If the actors are not savages, but soldiers of our own day, the fact is not less significant, as will be shown by the following account of an eye-witness, a thorough fighting man, an enforced spectator, held to the ground by a wound.

During the Crimean war on the day of a general action, at a turn in one of the numerous ravines which covered the country, some "Red" soldiers and some "Blue" soldiers came unexpectedly face to face at a distance of 10 paces. They halt, paralyzed—and then—as though forgetting their rifles, throw stones at each other and fall back. Neither of the two groups has a definite leader to carry it forward, and neither of the two dares fire first for fear the other may bring rifle to shoulder at the same moment. They are too close together to hope to escape, or at least they think so (for mutual fire at such short range is almost always too high);—but the man who fires first sees himself already killed by the return shot; he throws stones—and that not very hard—to distract his own mind from his rifle, to distract the enemy, in a word, to occupy the

time until his withdrawal may give him some chance of escaping a point-blank fire. This agreeable situation does not last long—a minute, perhaps; the appearance of a Blue troop on one flank causes the Reds to fly, and then the opposing group opens fire.

Certainly, the affair seems ridiculous and laughable. Let us see, however. In the midst of their native forest, a lion and a tiger meet face to face at a turn in the trail; they halt instantly, crouched ready to spring. With their eyes they measure each other, growling. With claws bared, mane erect, tail thrashing the ground, neck stiffened, ears flattened, lips drawn back, they show their formidable fangs in that terrible grimace of menace and of fear characteristic of felines. I, an invisible spectator, tremble. For the lion as for the tiger, the situation is not a happy one. One movement in advance and a beast will die; which of them will it be?—both, possibly. Gently, very gently, one of those hind legs bent for the spring unbends again, and carries the foot a fraction of an inch to the rear; gently, very gently, a fore paw follows the movement; after a wait, gently, very gently, the other legs do the same, and insensibly the two beasts, little by little, and always facing each other, draw apart, draw apart, until, when their mutual withdrawal has put between them a space greater than that of a single leap, lion and tiger softly turn their backs and, still watching each other, move more freely, taking up again without haste their natural gait, with that sovereign dignity which befits such great lords. I have ceased trembling, but I do not laugh.

No more should we laugh at the man, for the latter bears in his hands a weapon more terrible than the fangs and claws of lion or tiger—the rifle, which instantly, without possibility of defense, sends one from life to death. One can understand then that no one at such short range is in haste, by cocking his own rifle, to cock that hostile rifle which will surely kill him. One hesitates to light the match which will blow up him and his enemy together. Who has not seen such cases between dogs, between dogs and cats, or between cats?

In the Polish war of 1831, two Russian cavalry regiments and two Polish regiments charged each other. Both sides charged with the same dash until, at the distance when faces could be recognized, the horses slowed down and both parties turned their backs. The Russians and Poles at this terrible moment recognized each other

as brothers and, rather than shed fraternal blood, fled from the combat as from a crime. That is the version of an eye-witness who tells the story, a Polish officer. How many troops of cavalry have so recognized each other as brothers! But let us resume:

When tribal groups became larger, and it was no longer possible to surprise at the same instant the entire population of a large territory, when a sort of public conscience grew up with the growth of society, warning was given in advance; formal declarations of war were made. Surprise is no longer the whole art of war, but it is to this day one of the means, the best, of making war.

Man can no longer murder his enemy while defenseless, for he has given the latter warning. He must expect to find him prepared and in force. He must fight—gain the victory, with the least possible risk—and so he carries an iron-shod club against the wooden stake, arrows against the iron-shod club, a shield against the arrows, a shield and breast-plate against the shield alone, long lances against short lances, tempered swords against untempered, chariots against men on foot, etc.

Man taxes his wits to kill without danger of being killed. His bravery is only his consciousness of his own strength, and it is not an absolute quality; before one stronger than himself he flees without shame. The natural instinct of self-preservation is so strong that he feels no shame in obeying it. However, thanks to defensive armor, there are fights that are hand-to-hand. How can he be sure otherwise? He must experiment to find out which is the stronger, and when the latter is recognized, no one can stand before him.

In these primitive combats, individual strength and courage play the leading part to such an extent that when the champion falls the nation is vanquished; that often by mutual and tacit agreement the combatants halt to watch in wonder and anxiety, that great sight, two champions at swords' points. Often the moral level of man rises even to self-sacrifice and tribes put their fate in the hands of champions who accept the trust and who alone fight. It is a matter of self-interest, to be sure, since no one can stand against the champion.

But intellect revolts against brute force. No one can stand against an Achilles, but no Achilles can stand against ten enemies who unite their forces and act in concert. Hence are born tactics, which prescribe in advance methods of organization and action to

bring the efforts of the combatants into concert, and discipline, which seek to guarantee that concert against the weaknesses of the individual.

So far we have seen man fighting man, like wild beasts, each man for himself, seeking the man whom he can kill, avoiding the man who can kill him. But now discipline and clearly formulated tactical rules compel solidarity between leader and soldier and among the soldiers themselves. In addition to intellectual progress there has been a moral progress. To compel solidarity in battle and to make tactical dispositions possible, is to count on the devotion of all and to raise all the combatants to the level of the champions of the primitive battles. The point of honor arises, and flight becomes shameful, for the soldier is no longer alone in his fight against hostile strength, but one of an organized band, and he who gives ground abandons both his leaders and his comrades. In all respects the fighting man has improved. Thus, reasoning has taught the power of efforts intelligently combined, and discipline has rendered such combination possible.

Are we about to see terrible battles—battles of mutual extermination? No. Men collected in a disciplined troop and governed by a regular method of fighting, by their tactics become invincible against an undisciplined troop; but this disciplined troop opposed to one disciplined like itself becomes again the primitive man who flies before a destructive force which he has proved or suspects to be greater than his own. The heart of man is not changed. Discipline holds the opponents face to face a little longer, but the instinct of self-preservation maintains its power, and with it the sense of fear.

Fear! There are leaders and soldiers who know it not—they are men of a rare stamp. The mass trembles—for one cannot suppress the flesh—and this trembling, under penalty of reckoning falsely, must enter as one of the essential data into all organizations, discipline, dispositions, movements, manoeuvres and methods of action, which all have for a definite object the curbing of fear, its deception and side-tracking among our own men, and its exaggeration among those of the enemy.

If the rôle of this trembling in ancient battles is studied, one sees that, of the races most expert in war, the strongest have been those which not only understood best the general conduct of war, but took into account the frailty of man and took the best precautions against it. It will be noticed that the most warlike races are not

always those whose military institutions and methods of fighting are the best or based on the soundest reasoning. Indeed, the warlike races have a large share of vanity. They reckon only on courage in their tactics; it seems as though they do not wish to admit the possibility of weaknesses. The Gaul, passionately fond of war, has a rude system of tactics, which, after the first surprise, always causes him to be defeated by the Greeks or the Romans. The Greek, warlike, but also politic, has a system of tactics far superior to that of the Gauls or Asiatics. Politic before all things, the Roman, to whom war is nothing but a means to an end, wishes that means to be perfect. He has no illusions, but takes account of the weakness of man and evolves the legion. But this is merely to affirm; the facts must be demonstrated.

CHAPTER II.

The tactics of the Greeks culminated in the phalanx, Roman tactics, in the legion; the tactics of the barbarians, in the phalanx—square, wedge-shaped, or lozenge-shaped formations.

The mechanism of these different battle-formations is explained in all elementary text-books; their mechanical power is discussed by Polybius, where he contrasts the phalanx and the legion. (Book XVIII.)

The Greeks were superior to the Romans in intellectual civilization; their tactics should, it would seem, be more skillfully devised. This is not the case at all. Greek tactics are based on mathematical reasoning; Roman tactics, on a profound knowledge of the human heart—not that the Greeks did not give great weight to morale and the Romans to mechanics, but their controlling considerations were different.

By what dispositions may the most powerful effort be obtained from a Grecian army? By what means may all the soldiers of a Roman army be made to fight effectively? The first question is still discussed. The latter has been solved in a manner which should satisfy those who asked themselves the question.

The Roman is not essentially a brave man. He presents no type of warrior as great as Alexander, and the impetuous valor of the barbarians, Gauls, Cimbri, and Teutons, kept him, I need scarcely say, in terror for years. But to the glorious courage of the Greeks and the temperamental courage of the Gauls, he opposes a courage

based on a far stronger sense of duty, imposed on the leaders by the most earnest patriotism and on the masses by a terrible discipline.

The discipline of the Greeks depends on the penalties and recompenses of public opinion; the discipline of the Romans does the like, but also depends on death. They flog to death, they decimate.

A Roman general asks himself how to conquer these enemies who terrify his men. He does so by raising their morale, not by enthusiasm, but by rage. He makes the lives of his men miserable by excessive labor and privations. He bends the spring of discipline until, at a given moment, it must break or be released against the enemy. A Grecian general makes his men sing the songs of Tyrtaeus. It would have been interesting to see them face to face.

But discipline is not enough to make a perfect system of tactics. Man in battle, we repeat, is a being whose instinct of self-preservation, at a certain point, dominates all other feelings. The object of discipline is to overrule this instinct by a greater fear; but discipline cannot accomplish this absolutely—it can only reach a certain point which cannot be passed. Of course, I cannot deny the striking examples where discipline and devotion have raised man beyond himself; but, if these examples *are* striking, it is because they are rare; if they are admired, it is because they are regarded as exceptions, and the exception proves the rule.

The determination of that moment when man loses his reasoning powers and becomes a creature of instinct is the basis of the science of combat. In its general application, it makes the strength of the Roman tactics, and, in its particular application, at a certain moment or to given troops, causes the superiority of Hannibal or of Caesar.

At the period we have reached, a battle is fought between masses more or less deep, commanded and supervised by leaders with a clearly formulated rôle. It consists in each mass of a series of individual fights, side by side, where only the front-rank man fights, and if he falls wounded or exhausted, is replaced by the man in the second rank, who, in the meantime, guards his flanks, and so on to the rear rank. Man quickly tires, physically and morally, in a hand-to-hand fight where he uses all his strength. These fights usually lasted but a short time. With equal morale, those best able to resist fatigue always won the victory.

During this combat of the first rank (of the first two ranks, one may say—one fighting, the other watching so close at hand), the men of the ranks in rear, a couple of paces away, await in inaction

their turn to fight which will not come to them unless their file-leaders are killed, wounded or exhausted. They are tossed about by the fluctuations of the struggle of the first ranks. They hear the crash of blows struck, and perhaps distinguish those which bite into the flesh. They see the wounded and exhausted drag themselves to the rear through the intervals of their ranks. Passive and enforced spectators of danger, they calculate its approach and measure with their eyes its chances, at each moment more to be dreaded. All these men, in a word, undergo all the emotions of combat in their keenest forms, and, not being sustained by the stimulus of fighting, they find themselves weighed down by the moral pressure of the greatest anxiety. They often are unable to hold their ground, but run before their turns come.

The best tactics, the best dispositions, are those which facilitate the succession of efforts, by best assuring the relief of the various ranks of each unit engaged, and by making possible the relief and mutual support of the different units employed; engaging at once no more than the number needed for the combat and holding the rest as a support and reserve beyond any immediate moral pressure. Therein lay all the tactical superiority of the Romans, and also in the terrible discipline which prepared for and enforced the execution of their tactics. They held out longer than others in battle, both on account of the endurance given them by their severe and continuous labor, and on account of their constant renewal of combatants.

By an error of reasoning, the Gauls could see nothing but the inflexible rank, and they were even known to tie themselves together, thus rendering relief impossible. They believed, as did the Greeks, in the power of masses and the driving force of deep formations. They would not understand that an accumulation of ranks is powerless to push forward the leading ranks, when these latter resist and balk before death. It is a strange error to believe that the rear ranks will advance against that which has made the front ranks give way. On the contrary, the contagion of retreat is so strong that a mere check at the head of a file means an actual movement to the rear at its tail!

Undoubtedly, the Greeks looked on the second part of their accumulated ranks as supports and reserves; but, the idea of mass

being predominant, they placed these reserves and supports too close at hand, forgetting the weakness of man.

The Romans believed in the power of masses, but from the point of view of morale. They did not multiply their ranks to add to the mass, but to give the combatants confidence of being supported and relieved. So they calculated the number of ranks according to the length of time the rear ranks could resist the moral strain.

Beyond the time during which man could, without being engaged, endure the anguish of watching the combat of the ranks in front of him, the Romans did not multiply their ranks. The Greeks, who sometimes piled up their ranks to thirty-two, never made this observation and calculation; and the rear ranks which, in their minds, were undoubtedly their reserves, found themselves, instead, forcibly carried away by the actual material disorder of the first ranks.

In the order by maniples of the Roman legion, the best soldiers, those whose courage had been tempered by the habit of war, waited firmly posted in the second and third lines, far enough away to escape injury by weapons. Here they could keep cool and not be carried away by the first line falling back through the intervals, but were still close enough to support the first line in time, or to complete its work by moving to the front.

When the three separate and successive maniples of the original cohort were united to form the cohort which was the tactical unit of Marius and Caesar, the same intelligence placed in the rear ranks, the steadiest soldiers, those of the longest service; the youngest and most impetuous were assigned to the front ranks. There is not a single man in the legion simply for the purpose of increasing its numbers or its mass. Each has his turn of action, each man in his maniple, each maniple in its cohort, each cohort in the line of battle.

We see what idea, with the Romans, governs the density of the ranks and the arrangement and number of the successive lines of combatants. The genius and tact of the general modified these normal dispositions. If his men were inured to war, well-drilled, firm, tenacious, on the alert to relieve their file-leaders, full of confidence in their general and comrades, the general decreased the density of his ranks, and even did away with entire lines by extending his front, in order to increase the number of men

actually engaged. Since his men were of a moral and sometimes of a physical tenacity greater than that of the enemy, the general knew that the rear ranks of the latter would not stand the strain long enough to relieve the front ranks, nor to wear out the relays of his own men. Thus Hannibal, a part of whose infantry (the Africans) was armed and drilled in the Roman fashion, whose Spanish foot-soldiers had the endurance of the Spaniard of today, whose Gallic soldiers were picked men, survivors of many hardships,—strong in the absolute confidence which he inspired in those about him, formed his men at Cannae in a single line of only half the depth of the Roman army, enveloped the latter (which had twice his strength) and exterminated it. Caesar at Pharsalus, for similar reasons, did not hesitate to diminish his depth, opposed Pompey's army of double his strength, a Roman army like his own, and crushed it.

Since we have mentioned Cannae and Pharsalus, we shall, by studying them, inform ourselves concerning the mechanism and the moral forces of the battle of ancient times,—two things which cannot be separated. We could not have chanced on better examples, on battles more clearly and impartially described; the former by Polybius, who got his information from the few who escaped from Cannae, and even from some of the victors themselves; the latter by Caesar with that impassive clearness with which he writes on the subject of war.

CHAPTER III.

ANALYSIS OF THE BATTLE OF CANNAE.

The account of Polybius.

Varro placed his cavalry on the right wing, resting on the river itself; the infantry was deployed near by and in the same line, the maniples closer to each other or with intervals more decreased than usual, and the maniples showing more depth than front. The allied cavalry on the left wing, closed the line, in front of which were posted the light troops. There were 80,000 foot and more than 6,000 horse in this army, counting the allies.

Hannibal at the same time moved his slingers and light troops across the Aufidus and posted them in front of his army. When the rest of his troops had crossed the river by two fords, he placed on his left wing, at the river bank, the Spanish and Gallic cavalry to oppose the Roman cavalry, and then on the same line half the

African heavy infantry, the Spanish and Gallic infantry, the other half of the African infantry, and finally the Numidian cavalry, which formed the right wing.

After he had so arranged his troops in a single line, he moved against the enemy with the Spanish and Gallic infantry, which was detached from the center of the line of battle, and, as it had been joined in a straight line with the rest, it formed, in the process of separation, the convex of a crescent which took from the center much of its depth, it being the plan of the general to begin the battle with the Spaniards and Gauls and to support them with the Africans.

This latter infantry was armed in the Roman fashion, having been equipped by Hannibal with arms which he had taken in previous battles from the Romans. The Spaniards and Gauls carried the shield, but their swords were very different. Those of the former were equally adapted to cutting or thrusting, while those of the Gauls could only be used for cutting, and that at a certain distance. The Spaniards, divided into two bodies by the Gauls, formed the center, with the Africans on both flanks. The Gauls were naked, the Spaniards dressed in shirts of purple linen, which was an extraordinary and terrifying spectacle to the Romans. The Carthaginian army was composed of 10,000 horse and a little more than 40,000 foot.

Aemilius commanded the Roman right, Varro the left; the two consuls of the preceding year, Servilius and Attilius, were in the center. On the side of the Carthaginians, Hasdrubal had the left under his command, Hanno the right, and Hannibal, who had with him his brother Mago, reserved for himself the command of the center. The two armies would be at no disadvantage from the sun when it rose, since one had wheeled toward the south, as I have remarked, and the other toward the north.

The action was begun by the light troops which, on either side, were in advance of the two armies. This first engagement gave no advantage to either side, but as soon as the Spanish and Gallic cavalry on the left approached, the fight grew warmer and the Romans fought with fury, more like barbarians than Romans. They did not fight according to the rules of their tactics, now withdrawing and now returning again to the charge, but, scarcely had they come to blows, when they leaped from their horses and each man engaged his adversary. Nevertheless, the Carthaginians had the better of it. The greater part of the Romans, after defending themselves with the greastest valor, remained dead on the field; the rest were driven along the bank of the river and cut to pieces without quarter.

The heavy infantry finally took the place of the light troops and came to blows. The Spaniards and Gauls held their ground at first and vigorously resisted the shock of assault; but they soon gave way before the weight of the legions and, opening the crescent, turned their backs and retired. The Romans followed them impetuously,

and broke the Gallic line all the more easily, because they (the Romans) had drawn in their wings toward the center where the heaviest fighting was. Now all the line did not engage at the same time, but the action was begun by the center, because the Gauls, being arranged in the form of a crescent, left the wings far behind them and presented to the Romans the convex side of the crescent. These latter, following closely the Spaniards and Gauls, and crowding toward the center at the point where the enemy had given ground, pushed so far to the front that they touched on either flank the heavy-armed Africans. These on the right of the Carthaginian line wheeling from right to left, found themselves on the flank of the enemy, as did those on the left who made the wheel from left to right. The very circumstances showed them what they had to do. It was what Hannibal had foreseen; the Romans, in pursuing the Gauls, could not fail to be enveloped by the Africans. The Romans then, no longer able to preserve their ranks and their files, were forced to defend themselves man to man, or by little detachments, against those who were attacking them in front and flank.

Aemilius had escaped from the carnage on the right wing at the beginning of the battle. Wishing, according to his promise, to be present everywhere, and seeing that it was the legionary infantry which would decide the fate of the battle, he pushed his horse through the mêlée, scattered or killed all who opposed him, and sought at the same time to revive the ardor of the Roman soldiers. Hannibal, who had remained in the mêlée throughout the battle, did the same on his side.

The Numidian cavalry on the right wing, without either doing or suffering much, did not cease to be useful on this occasion, for, falling on its enemies from all sides, it gave them so much to do that they had no time to think of helping their comrades. But when the left wing, which Hasdrubal commanded, had put to rout all except a very few of the cavalry of the Roman right, and had joined the Numidians, the auxiliary cavalry (on the Roman left) did not wait to be attacked, but fled.

They say that Hasdrubal then did a thing which proves his prudence and skill, and which contributed to the success of the battle. As the Numidians were numerous, and as these troops are never more useful than in pursuit, he gave them the fugitives to pursue, and led the Spanish and Gallic cavalry at the charge to assist the African infantry. He fell on the Romans in rear and, charging with his cavalry in a body into the mêlée at several points, gave new strength to the Africans and made the weapons fall from the hands of the enemy. It was here that Lucius Aemilius, a citizen who, through all his life as in this last battle, had nobly fulfilled his duty toward his country, finally fell, covered with mortal wounds.

The Romans still fought, and, facing those by whom they were surrounded, resisted to the end. But as the troops on the circumference

became fewer and fewer, they were finally drawn into a very narrow circle and were all put to the sword. Attilius and Servilius, two men of high character who had distinguished themselves in the battle as true Romans, were also killed on this occasion.

During the carnage at the center, the Numidians pursued the fugitives of the left wing. Most of the latter were cut to pieces, and others were thrown from their horses. A few escaped to Venusia, among whom was Varro, the Roman general, that wretched man whose consulship cost his country so dear. Thus ended the battle of Cannae, a battle where prodigies of valor are seen on either side, as may easily be proved.

Of the 6000 Roman cavalry, only 70 escaped to Venusia with Varro, and, of the auxiliary cavalry, there were only about 300 who fled to different towns; 10,000 of the foot, indeed, were captured, but they had not taken part in the battle. Only about 3000 men escaped from the mêlée to take refuge in the neighboring cities; all the rest, to the number of 70,000, died on the field of honor. Hannibal lost in this action about 4000 Gauls, 1500 Spaniards and Africans, and 200 horse.

Let us analyze: The light infantry scattered in front of the armies skirmishes without result. The real battle begins with the attack by Hannibal's cavalry on the legionary cavalry of the Roman left wing.

There, says Polybius, the fight became warmer and the Romans fought with fury, and more like barbarians than Romans, for they did not keep withdrawing and coming again to the charge according to their tactical rules; scarcely had they come to blows when they leaped from their horses and each man engaged his adversary, etc.

This means that the Roman cavalry was not in the habit of fighting hand to hand like the infantry. It dashed at the gallop on the opposing cavalry; then, at the extreme range of its weapons, if the hostile cavalry had not turned to the rear on seeing its approach, slackened its pace, threw a few javelins, and, making a half-wheel by platoons, proceeded to take ground to begin all over again. The opposing cavalry did the like, and this, or a similar manoeuver might be repeated several times until one side succeeded in convincing the other by the impetuosity of its advance, that it intended to charge home, when the latter fled before the charge and was pursued to the death.

At Cannae, as the fight became warmer, they really fought hand

to hand—that is to say, the cavalry of both sides closed in earnest and engaged man to man. Besides, it was a matter of necessity. Far from falling back on each side, they were compelled on that day to close; there was no space for skirmishing. Shut in between the Aufidus and the legions, the Roman cavalry could not maneuver*; the Spanish and Gallic cavalry was equally restricted, and, being twice as strong as the Roman cavalry, and so forced to form in two lines, was even less able to maneuver. This limited front was of great advantage to the Romans, inferior in numbers, since they could only be attacked in front—that is to say, by an equal number—and it rendered, as we have said, close fighting inevitable. These two bodies of cavalry, halted head to breast, were compelled to fight at short range, to engage man to man, and, for horsemen with a piece of cloth for a saddle and without stirrups, encumbered with a shield, a lance, and a sabre or sword, to engage hand to hand is for both to grasp each other, for both to fall to the ground, and to fight on foot. That is just what happened, as Livy's story (which completes that of Polybius) explains, and it is just what happened every time two bodies of cavalry of that period really wanted to fight, as the battle of the Ticinus shows. This method of fighting was to the advantage of the Romans who were well armed and were trained to it. An evidence of this also is that same battle of Ticinus, where the Roman light infantry was cut to pieces, but where the best of the Roman cavalry, although surrounded and, after the first moment of surprise, fighting partly on foot and partly mounted, inflicted more damage on Hannibal's cavalry than they received, and brought their wounded general (Scipio) safely back to camp. The Romans were, moreover, well commanded by a man of sense and courage, the consul Aemilius, who, instead of escaping when his cavalry was defeated, went to meet his death in the ranks of the infantry.

And yet we see 3000 to 3400 Roman cavalry almost exterminated by 6000 or 7000 Gauls and Spaniards, at a cost of less than 200 men (for all Hannibal's cavalry lost only 200 men throughout the day).

How can this be explained? It was because most of them died without even thinking of selling their lives dearly; because they took to flight during the fight of the first rank and were cut down from the rear with impunity. These words of Polybius: "The greater

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* Livy.

part remained dead on the field after defending themselves with the greatest valor," are a consecrated formula; they date from long before the time of Polybius; the conquered consoled themselves with the thought of their bravery, and the conquerors never contradicted them. Unfortunately, the figures are there. In whatever way we try to view this battle, one is compelled to picture it as of short duration, which means that it was not desperately fought. The horsemen of both sides, Gauls and Romans, had already made a great effort of courage in closing with each other. This effort was followed by the terrible strain of hand-to-hand combat. The Romans, who could see the second line of Gauls mounted behind those fighting on foot, were the first to give ground. Fear soon impelled the ranks not actually engaged, to mount and turn to the rear, delivering their comrades and themselves, like a flock of flying sheep, to the swords of the conquerors. And yet these cavalrymen were brave men, the pick of the army, equities, extraordinarii (or consular body-guard taken from the allied legions) and volunteers of noble families.

When the Roman cavalry was defeated. Hasdrubal led his Gallic and Spanish horse, passing in rear of Hannibal's army, to attack the allied cavalry, which the Numidians had been keeping in play. The cavalry of the allies did not wait for the attack. It fled at once, pursued to the death by the Numidians, of whom there were about 3000, and who excelled in pursuit: All but about 300 men were exterminated, and that without a fight.

After the skirmishing and withdrawal of the light infantry, the infantry of the line of both armies approached each other. Polybius has explained to us how the Roman infantry came to be crowded between the two wings of the Carthaginian army, and was taken in rear by Hasdrubal's cavalry. It is probable also that the Gauls and Spaniards, repulsed in the first part of the action and forced to retreat, returned and aided by a part of the light infantry, charged the head of the angle formed by the Romans, and completed the work of surrounding them.

But we know, as will be seen again a little later in examples taken from Caesar, that the horseman of this period was powerless against unbroken infantry, or even against a single foot-soldier with the least presence of mind, and the Spanish and Gallic cavalry must have found behind the Roman army the *triarii* drawn up, very

steady soldiers, armed with pikes. The cavalry must have kept a part of these in play and forced them to face about, but it could have done them little or no harm while their ranks were kept intact.

We know that Hannibal's infantry, equipped with Roman arms, was composed of not more than 12,000 men; we know that his Gallic and Spanish infantry, with only the shield for defensive armor, had been forced to retreat and turn their backs, and had probably already lost nearly all of the 4000 men which the battle cost the Gauls. Let us deduct the 10,000 men who went to attack Hannibal's camp and the 5000 which the latter must have left to defend it. There remains a mass of 70,000 men which is surrounded and slaughtered by 28,000 foot-soldiers, or, counting Hasdrubal's cavalry, by 36,000 men,—by half its own number.

One may ask how 70,000 men let themselves be slaughtered in this way, practically without defending themselves, by 36,000 men with inferior arms, when each combatant had but a single man facing him; for in a hand-to-hand fight (and especially on so large a scale) the combatants actually engaged are equal in number in the force which surrounds and in that which is surrounded. There were no cannon or rifles there which could dig into the mass with converging fire and destroy it by the superiority of convergent over divergent fire. All the missile weapons were expended in the first period of the action. It seems as though, by their very mass, the Romans should have offered a resistance impossible to overcome, and that, after allowing the enemy to exhaust himself against it, this mass had only to let itself go to drive its assailants like straw. But it was exterminated.

When, following the Gauls and Spaniards who certainly could not hold their own against the superior arms of the legionaries, the center pushed vigorously to the front—when the wings, in order to support the center and not lose their intervals, followed its movement, closing in by an oblique march to the front and forming the sides of the salient,—the entire Roman army in a wedge formation was marching to victory. Suddenly the wings were attacked by the African battalions. The retreating Gauls and Spaniards turn on the point of the wedge. Hasdrubal's cavalry in rear attacks the reserves (the triarii). Everywhere fighting, without expectation or warning, at the moment when they believed themselves victors—from all directions, front, right, left, and rear, the Roman soldiers hear the furious cries of the combatants.

The physical pressure was a small matter; the ranks they were fighting were not half as deep as their own. The moral pressure was enormous. Uneasiness and then terror take possession of them. The front ranks, tired or wounded, wish to retire; but the bewildered ranks in rear fall back, give way entirely, and come whirling into the interior of the triangle. The ranks actually engaged, demoralized and feeling that they are no longer supported, follow them, and the disorganized mass allows itself to be slaughtered. "The weapons fell from their hands," says Polybius.

The analysis of Cannae is ended. Before passing to the story of Pharsalus, I cannot resist the temptation, although it is rather outside my subject, to say more words on Hannibal's battles.

These battles have a character of peculiar ferocity, which is explained by the necessity of overcoming the tenacity of the Romans. One would say that victory was not enough for Hannibal. He seeks for the destruction of his enemies, and his methods always tend to accomplish it by cutting off all their lines of retreat. He knows well that, with Rome, destruction is the only way to settle the matter. He does not believe in the courage of despair among masses of men; he believes in terror and, to inspire it, he has at his command all the resources of the unexpected.

But the losses of the Romans in these battles are not so surprising as Hannibal's losses. No one, before him or after him, has lost so many men in battle against the Romans, and yet gained the victory. To hold to their work until victory ensues, men who have suffered such losses, requires a strong hand. He inspired an absolute confidence in those about him. Almost always his center, where he placed his Gauls—his food for powder—was routed; but that did not seem to worry or trouble either him or his soldiers.

One may say, on the other hand, that this center was pierced by troops who were escaping from the crushing of the Roman army between the Carthaginian wings; that these troops were in disorder, for they had fought and driven back the Gauls, whom Hannibal knew how to make fight with remarkable tenacity; that they felt, from what was going on behind them, as though they had escaped from under a press, and—only too happy to be out of it—thought of nothing but getting away from the battle, and not at all of turning on the flanks or rear of the enemy; and, finally, that Hannibal had doubtless, though nothing is said about it, taken precautions against any idea on their part of coming back into the fight.

All this is true, or, at least, probable, but the confidence of troops with their center so pierced is not the less astonishing. Hannibal, to inspire such confidence in his troops, must have explained his plans to them before the battle, as far as he could without fear of injury from any treachery. He must have warned them that the line would be pierced, but that it was nothing to worry about, because it was an event foreseen and prepared for. His troops, as a matter of fact, did *not* worry about it.

Leaving aside the strategy of his campaigns, his greatest glory in the eyes of the world, Hannibal is certainly the greatest general of antiquity in his wonderful knowledge of the moral side of battle and of the morale of the soldier—his own or the enemy's—a knowledge as deep as anyone's can be in the various sudden changes of a war, a campaign, or a battle. His soldiers are no better than the Roman soldiers; they are not as well armed and only half as numerous. Yet he is always the victor because his methods are, above all, mental rather than physical methods, and because, without speaking of the absolute confidence of his men, he always has the faculty, when commanding one of his own armies, of putting, by some device, the moral ascendency on his own side.

He had, in Italy, a cavalry superior to the Roman cavalry. But the Romans had a far superior infantry. Suppose the rôles changed; he would very certainly have found a way to beat the Romans still more thoroughly. The means are not so important as the use one knows how to make of them. Pompey, as we shall see, was beaten at Pharsalus for the very reason that his cavalry was superior to Caesar's.

If Hannibal was conquered at Zama, it was because the power of genius is always limited by the impossible. Zama proves again what a perfect knowledge of man Hannibal possessed, and what control he had over his troops. His third line, the only one where he had soldiers worthy of the name, was the only one which fought; and, surrounded on all sides, it accounted for 2000 Romans before it was conquered.

We shall understand later what high morale and what desperate fighting that means.

CHAPTER IV.

ANALYSIS OF THE BATTLE OF PHARSALUS.

Here now is the account of Pharsalus according to Caesar:

When Caesar had approached the camp of Pompey, he observed that the latter's army was drawn up in the following order:

On the left wing were the two legions called the 1st and 3d, which Caesar had sent to Pompey at the beginning of the troubles, in accordance with a decree of the Senate; and there was Pompey himself. Scipio occupied the center with the Syrian legions. The Cilician legion, with the Spanish cohorts which Afranius had had brought with him, were placed on the right wing. Pompey considered these troops the steadiest of his army. Between them, that is, between the center and the wings, he had distributed the rest of his troops, and counted altogether 110 full cohorts in his line of battle. They were 45,000 strong. Two thousand veterans, previously rewarded for their services, had come to rejoin him, and these he had scattered along the line of battle. The other cohorts, to the number of seven, had been left to guard his camp and the neighboring forts. His right wing rested on a brook with impassable banks, and, for this reason, he had put all his cavalry (7,000 men) and his archers and slingers (4,200 men) on the left wing.

Caesar, keeping his old order of battle (4 cohorts of each legion in the first line, 3 in the second, and 3 in the third), had placed the 10th and 9th legions on the right and left wing, respectively. To the latter, which had been very much weakened by the fighting at Dyrrachium, he joined the 8th, in order to make about one full legion of the two, and ordered them to support each other. He had in line 80 nominal cohorts (very incomplete), amounting to 22,000 men. Two cohorts had been left to guard the camp. Caesar had given the command of the left wing to Antonius, that of the right to Sylla, and of the center to Domitius. Caesar, himself, took post opposite Pompey. After he had reconnoitred the formation of the hostile army, he feared that his right wing might be envolved by the numerous cavalry of Pompey, and, at the last moment, took from his 3d line one cohort of each legion (6 cohorts) and formed of them a 4th line, posted it to receive the charge of this cavalry, and showed it what it had to do. He then warned these cohorts that the success of the day depended on their valor. At the same time he ordered all the army, particularly the 3d line, not to advance without orders from him, keeping in his own hands the power of giving the signal by means of the standard, when he the time had come.

Caesar then rode his lines to exhort his troops to do their best, and, seeing them full of ardor, had the signal given.

Between the two armies there was just the space necessary for each side to charge. But Pompey had ordered his troops to await the charge without moving, and to let Caesar's army break its own ranks. He did so, it is said, on the advice of Triarius, in order that the force of the first dash of Caesar's soldiers might be exhausted and their battle-formation broken, and that his own men, well posted in their ranks, might, sword in hand, have nothing to receive but men in disorder. He also thought that, if his troops held their ground instead of running to the front, they would lessen by just that much the force of the pila thrown against them, and he hoped, at the same time, that Caesar's soldiers, by this charge of double the usual length, would be out of breath and overwhelmed with fatigue. This order to stand fast would seem to us to be an error on the part of Pompey, because there is in all men an animation, a natural ardor, which is inflamed by the charge. Generals should not repress, but rather increase this ardor, and it is not in vain that the rule was established in ancient times for the troops to cheer and all the trumpets sound in advancing to the attack, in order to terrify the enemy and inspire our own men.

Meanwhile, our soldiers, at the given signal, rush forward, pilum in hand, but, when they see that Pompey's men do not run to meet them, they slacken their pace of their own accord, taught by experience and by former battles, and halt in the middle of their charge in order not to arrive out of breath and at the end of their strength. After several moments they take up the charge again, throw their javelins, and then immediately, in accordance with Caesar's orders, draw sword.

Pompey's men bear themselves perfectly. They do not flinch from the javelins or give before the charge of the legions. They keep their formation and, after casting their pila, draw their swords.

At the same time all Pompey's cavalry dashes forward from the left wing, as it had been ordered to do, and the swarm of archers spreads in all directions. Our cavalry does not await the charge, but gives ground and falls back a little. Pompey's cavalry becomes only the more eager on this account, and begins to deploy its squadrons and to turn our exposed right flank. As soon as Caesar sees its intention, he gives the signal to his 4th line, composed of six cohorts. These move at once and (with ensigns lowered) charge Pompey's horse with such spirit and resolution that not one holds his ground, but all not only turn and leave the field, but, carried away by their flight, escape to the mountains. When the cavalry have gone, the archers and slingers, left without support, are all killed. By the same movement, these cohorts move in rear of Pompey's left wing, whose army is still fighting and resisting, and take it in rear.

At the same time Caesar advances his 3d line which, until this moment, has remained quietly in position. These fresh troops

having relieved those who were exhausted, Pompey's soldiers, taken in rear, can no longer hold their ground and all take to flight.

Caesar was not mistaken when he told these cohorts, which he posted as a 4th line to oppose the cavalry and exhorted them to do their best, that the victory would come from them. By them, as it turned out, the cavalry was repulsed; by them the throng of slingers and archers was cut to pieces, and by them Pompey's left wing was turned and the rout of his army determined.

As soon as Pompey saw his cavalry repulsed and that part of the army on which he most relied struck with terror, having little confidence in the rest, fled on horseback to his camp, where, addressing the centurions who were guarding the praetorian gate, he said in a loud tone in order to be heard by the soldiers: "Guard well the camp and defend it vigorously in case of misfortune; as for me, I am going to make the round of the other gates and see to the defense of the posts." This said, he retired to the praetorium, despairing of success, yet awaiting the outcome.

After having forced his routed enemies to take refuge in their entrenchments, Caesar, convinced that he should not give them the least respite from their terror, exhorted his soldiers to profit by their advantage and to attack the camp; and the men, though overcome with the heat, for the fight had been prolonged until midday, did not balk at any fatigue but obeyed. The camp was well defended at first by the cohorts which were guarding it, and particularly by the Thracians and barbarians. The soldiers who had fled from the battle, terrified and exhausted, had almost all thrown away their arms and their ensigns and thought far more of escaping than of defending the camp. Soon, even those who were holding their ground on the parapets could not resist the cloud of missiles. Covered with wounds, they abandoned their post and, led by their centurious and tribunes, fled to the high mountains which were near the camp.

Caesar lost only 200 soldiers in this battle, but about 30 of the bravest centurions were killed. About 15,000 men of Pompey's army perished, and more than 24,000, who had taken refuge in the mountains and whom Caesar had surrounded with entrenchments, came in and surrendered the following day.

Such is Caesar's account. The points of this story stand out so clearly that comment is scarcely necessary.

Caesar employed the habitual order of battle of three lines, consecrated by custom in Roman armies, yet not absolutely prescribed, for Marius is seen to fight with only two lines. But the genius of the leader, as we have already said, on occasion modified the rules. There is no reason to suppose that the army of Pompey was not in the same formation.

To oppose this army, twice the strength of his own, Caesar, had he kept the regular formation of 10 ranks to the cohort, could have formed only a first line, and a second of half its strength, as a reserve. But he knew the worth of his troops and he knew, we have also said, what weight to give to the apparent strength of deep ranks. Accordingly, he did not hesitate to diminish the depth of his ranks in order to preserve intact up to the moment of their engagement the good order and morale of three-fifths of his troops. Again, in order to be more certain of his third line, his reserve, and to prevent its yielding to the temptation to forget its anxiety in action, he gave it very particular orders, and, possibly, for the text lends itself to that interpretation, held it at double the usual distance in rear of the combatants.

And then, for the purpose of parrying the turning movement of Pompey's 7,000 horse and 4,200 slingers and archers—a movement on which Pompey rested his hope of victory—he set aside six cohorts, scarcely 2,000 strong. He had perfect confidence that these 2,000 men would repulse the cavalry, and that his own 1,000 horsemen would then know how to push them so sharply that they would never even think of rallying. It happened as he had planned, and the 4,200 archers and slingers were slaughtered like sheep by these cohorts aided, doubtless, by the 400 young and agile foot-soldiers Caesar had joined to his 1,000 horsemen, and who remained behind for this work, leaving the horsemen, whom they would have delayed, to pursue the terrified fugitives. Here we see 7,000 horse swept aside, and 4,200 foot slaughtered without a fight, all demoralized by a mere vigorous demonstration.

Pompey's order to his infantry to await the charge is judged too severely by Caesar. Undoubtedly his general proposition is correct. One should not chill the ardor of his troops, and the initiative of attack *does* give the assailant a certain moral superiority. But, with steady and duly warned soldiers one may attempt a trap, and Pompey's men proved their steadiness by awaiting, without flinching, the charge of an enemy in good order and full of vigor, when they had counted on receiving them in disorder and out of breath. Although it did not succeed, the advice of Triarius was not bad; the very conduct of Caesar's soldiers proves it. This advice and conduct show the importance of the material rank in ancient battles. In its assurance of support and mutual aid, it was the basis of the soldier's confidence.

In spite of the fact that Caesar's men had the initiative of attack, the first shock was not decisive. There was a fight on the spot—a fight of several hours' duration—and here are 45,000 good soldiers, who, after a fight where they lose scarcely 200 men (for, equal in weapons, courage and swordsmanship, Pompey's infantry should not lose more than Caesar's in hand-to-hand fighting), are stampeded, and, in the flight from the battlefield to their camp, are slaughtered to the number of 12,000.

The ranks of Pompey were twice as deep as those of Caesar. The charge of the latter could not drive them back a single step. On the other hand, their mass was powerless to repulse the charge, and they fought at the point of meeting. Pompey had announced to his men, Caesar tells us, that the hostile army would be turned by his cavalry, and suddenly, while they are fighting bravely, foot to foot, they hear behind them the uproar of the attack of Caesar's six cohorts—2,000 men.

Does it seem that for such a mass of men to ward off this danger was an easy matter? It was not. The wing thus taken in rear gives ground. Little by little, the contagion of fear carries away the rest; and their terror is so great that they do not think of reforming in their camp, defended for a moment by the cohorts on guard. As at Cannae, the weapons fall from their hands. Without the firm stand of the camp guards which made it possible for the fugitives to reach the mountains, the 24,000 prisoners of tomorrow would have been the corpses of today.

Cannae and Pharsalus have sufficed at least to give us some understanding of the battles of ancient times. Let me add, however, several other characteristic quotations, which I shall quote briefly and in chronological order. The lessons will be more complete.

Livy tells how in some battle against the tribes near Rome (I do not know which) the Romans did not dare pursue for fear of breaking their ranks. In a battle against the Hernici, he shows us the Roman horsemen, unable, mounted, to do anything toward breaking the enemy, begging the consul for permission to dismount and fight as infantry. And the Roman horsemen are not peculiar in this; in later times, the best horsemen, the Gauls, the Germans, and even the Parthians, are seen to dismount in order to fight in earnest.

The Volscii, the Latins, the Hernici, and others are united in a

multitude to fight the Romans; the battle is nearing its end and, Livy tells us: "Then, when the first rank has fallen, each man *sees that the slaughter has finally reached him* and takes to flight; then, hard pressed, they *throw aside their arms* and disperse in flight. Now the cavalry dashes forward, with orders not to kill individuals, but to annoy the crowd with its missiles, to harass it without ceasing, in a word, to check its flight and prevent its scattering until the infantry can come up and massacre it."

In Hamilcar's battle against the rebel mercenaries, who had up to that time always defeated the Carthaginians, the mercenaries thought to envelop him. Hamilcar, by a manoeuvre new to them, surprised and beat them. He marched in three lines—elephants, cavalry and light infantry, and then the heavy-armed phalanges. On the approach of the mercenaries, who advanced boldly to meet him, the two lines formed by the elephants, and the cavalry and light infantry, turned their backs and hastened at full speed to the flanks of the third line. The third line, thus unmasked, met an enemy who thought he had nothing to do but pursue, surprised and put him to flight, and so delivered him to the action of the elephants, the horse, and the light infantry, by whom the fugitives were massacred. Hamilcar killed 6,000 men, took 2,000 prisoners, and lost so few that no mention is made of them. Probably he did not lose a man, since there was no fight.

At Trasimenus, the Carthaginians lost 1,500 men (almost all Gauls), the Romans lost 15,000 killed and 15,000 prisoners. This was a hotly-contested battle, lasting three hours.

At Zama, Hannibal had 20,000 killed and 20,000 captured, the Romans had 2,000 killed. This was a hard-fought battle with Hannibal's third line, which alone fought and did not give way until attacked in rear and flank by Massinissa's cavalry.

At the battle of Cynoscephalae between Philip and Flamininus, Philip pushed Flamininus with his phalanx, 32 deep. Twenty maniples took the phalanx in rear. Philip lost the battle. The Romans counted 700 killed, the Macedonians, 80,000 killed and 5,000 captured.

At Pydna—Aemilius Paulus against Perseus—the phalanx advances and cannot be stopped, but it breaks up naturally in accordance with the greater or less resistance it encounters. The centuries force their way into the openings in the mass and kill the soldiers,

hampered by their pikes and only formidable when united and attacked from the front at spear's length. Terrible disorder and slaughter results; 20,000 are killed and 5,000 are captured out of 44,000 engaged. The historian does not design to mention the Roman losses.

In the battle of Aix Marius caused the Teutones to be surprised in rear. Fearful carnage ensued—100,000 Teutones and 300 Romans were killed.

The battle of Chaeronea, Sulla against Archelaus, the lieutenant of Mithridates—Sulla had 30,000 men. Archelaus 110,000. Archelaus was defeated by a surprise from the rear. The Romans lost 14 men and killed until exhausted by the pursuit. The battle of Orchomenus against the same leader was a repetition of Chaeronea.

Caesar tells how his cavalry could not fight the Britons without great disadvantage because these latter feigned flight to get away from the infantry and then, jumping out of their war-chariots, *fought on foot with success*.

Less than 200 veterans embarked on a ship and ran ashore at night to avoid being captured by superior naval forces. They gained a strong position and passed the night there. At daybreak, Otacilius sent against them about 400 cavalry and some infantry of the garrison of Lissus. They defended themselves bravely and, after killing several of their opponents, joined Caesar's troops without having lost a single man.

Caesar's rear guard is struck by Pompey's cavalry at the crossing of the river Genusus in Macedonia—a river with very steep banks. Caesar opposes Pompey's cavalry, 5,000 to 7,000 strong, with his cavalry of 600 to 1,000 men, with whom he has taken care to mix 400 picked infantrymen. These do their work so well that in the fight which follows they repulse the enemy, kill a number of them, and fall back on the main body without the loss of a single man.

At the battle of Thapsus, in Africa, against Scipio, Caesar kills 10,000 men, and loses only 50 killed and a few wounded.

At the battle under the walls of Munda (in Spain) against one of the sons of Pompey, Caesar has 80 cohorts and 8,000 horse, about 48,000 men in all. Pompey has 13 legions—60,000 infantry of the line, 6,000 horse, 6,000 light infantry, and 6,000 auxiliaries, in all, nearly 80,000 men. The battle, says the narrator, was bravely fought, foot to foot and sword to sword. It was one of exceptional

fury, where fortune, for a long time uncertain, was on the point of turning against Caesar. Caesar lost 1,000 killed and 500 wounded. Pompey lost 33,000 killed, and if Munda had not been so near (scarcely two miles away), his losses would have been doubled. The contravallations of Munda were built of corpses and arms.

In studying the battles of ancient times, it is evident that they are nearly always won by an attack in flank or rear, or some form of surprise, especially when won against the Romans. It was in this way that their excellent system of tactics sometimes miscarried—a system so excellent that a Roman general, who was only half as good a man as his adversary, was sure to beat him. I have never seen them conquered in any other way. Xanthippus,—Hannibal,—the unexpected methods of fighting and strange appearance of the Gauls, etc., bear witness to the truth of this statement.

Xenophon somewhere says: "Whatever it may be, agreeable or terrible, the less it has been foreseen, the more pleasure or terror it causes. This is seen nowhere more than in war, where any surprise strikes with terror even those who are much the braver.

Combatants armed with breastplate and shield lost very few in fighting face to face. In his victories, Hannibal lost practically no men except among the Gauls, his food for powder, fighting with inferior shields and without armor. Almost always driven back, they nevertheless fight with a tenacity which they have never shown before or since his time.

Thucydides characterizes the fighting of the light-armed troops when he says, in one account: "As usual, the light-armed troops put each other mutually to flight." In fighting with closed ranks, there was a mutual shoving, but little loss, for the men had no room to strike freely and with their full strength.

Caesar, in his campaign against the Nervii, seeing his men in the midst of an action instinctively closing in to resist the mass of the barbarians and yet yielding to the pressure, *ordered the ranks and files extended*, so that the legionaries, who had been crowded together and consequently paralyzed and obliged to yield to the stronger force, could kill and so demoralize the enemy. As a result, as soon as men in the first rank of the Nervii began to fall under the blows of the legionaries, there was a check, a recoil, and then, under an attack in rear, this whole mass fell into confusion and defeat.

CHAPTER V.

We are now enlightened on the moral aspects and the mechanism of the battle of ancient times. The expression "mêlée," employed by the ancients, was a thousand times stronger than the thing it was intended to express. By "mêlée" a mere crossing of swords was meant, not an actual intermingling of men.

The results of the battles and the losses of both sides are enough to show us this, and a moment's reflection makes us see what a mistake the mêlée would have been. In the pursuit one might throw oneself among the flying sheep, but during the fight each man had too much need of those behind and beside him, who were guarding his flanks and rear, to go gaily to certain death on the enemy's ranks.

With the mêlée, moreover, where would the victors have been? With the mêlée, Caesar at Pharsalus and Hannibal at Cannae would have been conquered; their shallower ranks, penetrated by the enemy, would have been forced to fight two to one, and would even have been taken in rear by the enemy breaking completely through.

Have we not also seen, with troops equally firm and determined, a common exhaustion cause both sides, by tacit agreement, to withdraw for a breathing spell before beginning again? How would this be possible with the mêlée? And I repeat, with the mêlée, the intermingling of combatants, there would have been a mutual extermination, but no victors. How would they have been recognized?

Can one conceive two crowds mingled by individuals or by groups, where each man, engaged with the enemy in his front, can be struck with impunity from the side or the rear? It means a mutual extermination where the victory rests with the last survivor, for in this intermingling, this mêlée, no one can fly, no one knows whither to fly. Besides, are not the common losses a sufficient proof?

The word is then too strong a one; it is in the imagination of painters and poets that the mêlée has been seen. This is what really used to happen:

At charging distance, they advanced on the enemy with all the speed compatible with the good order necessary for free use of the sword and mutual support of the combatants. Very often the moral impulse, that resolution to charge home shown by good order and

unhesitating gait, alone put to flight a less resolute enemy. Ordinarily, with good troops, there was a shock, but not a blind meeting of the masses with lowered heads. Their care for the preservation of their formation was too great for this, as is shown by the conduct of Caesar's soldiers at Pharsalus, or the slow march to the sound of flutes of the Lacedaemonian battalions. At the moment of meeting, the speed slackened naturally, for the man in the first rank involuntarily and instinctively assured himself that his supports—his neighbors in the first rank and his comrades in the second—were in their proper places, and gathered himself in order to have more control of his movements to strike and parry. There was a meeting man to man; each one took the adversary before him and attacked him in front, for, by breaking through the ranks before defeating him, he lost his supports and risked wounds from the side. Each one, therefore, struck his man with his shield, hoping to make him lose his balance and to strike him while trying to recover it. The men of the second rank, in rear opposite the intervals in the first necessary for a free use of the sword, were ready to protect his flanks from anyone breaking through and to relieve the exhausted. The third rank and those behind it did the same. Since, therefore, both sides were braced for the shock, it was rarely decisive, and the fencing, the real hand-to-hand fighting, began.

If the men in the first rank on one of the sides were quickly wounded, the other ranks were in no hurry to relieve or replace them, and there was hesitation and then defeat. Thus it was with the Romans in their first meetings with the Gauls. The Gaul, with his shield, parried the first thrust and, striking down furiously with his great iron sabre on the top of the Roman shield, split it and reached the man beneath. The Romans, already wavering before the moral impulse of the Gauls, their fierce cries and their nakedness (a sign of their contempt for wounds), at this moment fell in greater numbers than their adversaries, and demoralization ensued. Soon they became accustomed to their enemy's impetuosity, brave but without tenacity, and, when they had trimmed the top of their shields with a strip of iron which turned and bent the Gallic sword, they no longer fell, and the roles were reversed.

The Gauls, indeed, could not hold their ground against the better arms and the thrusting sword of the Romans, whose superior individual tenacity was multiplied almost tenfold by the possible relays of the eight ranks of the maniple. And even the maniples relieved

one another. With the Gauls the duration of the fight was limited by the strength of a single man. Their too crowded and disorderly ranks rendered relief difficult, or impossible, as, for example, when they tied themselves together, as has been described.

If the arms were nearly equal, to keep one's own ranks, and to break, drive back and confuse, those of the enemy was to conquer. The man in disordered and broken ranks feels that he is no longer supported but exposed on all sides, and he runs. It is true that one can scarcely break the enemy's ranks without breaking one's own; but in the latter instance the man is advancing. He has only been able to advance because he is driving back the enemy before his blows, killing or wounding him; he is doing a thing which he has expected and intended, which raises his courage and that of his neighbors; he *knows* and *sees* where he is going; while the enemy, left behind by the withdrawal, or by the fall of the men on either side, is surprised, and sees himself exposed on the flanks; to get support, he falls back himself, in line with the rank in the rear of him. But his adversary also pushes forward, and the rank in rear is no longer to be found. The ranks in rear yield to the recoil of the leading ranks, and if this recoil continues for any length of time or is violent, a fear of the blows which are thus pushing back and perhaps striking down the first rank arises. If, in order to make way more quickly and easily for the pressure, and in order not to fall and be piled one on another, the rear ranks turn their back for several steps, there is very little chance that they will again turn their faces to the front. Space has tempted them—they will turn back no more.

Then, by that natural instinct of the soldier to worry about and to assure himself of his supports, this fear passes from the last ranks to the first, which, so closely engaged, has, in the meantime, been compelled to keep faced to the front under pain of immediate death; and what follows need no longer be explained—it is massacre.

Let us return to the combat. It is evident that the exact line formation of troops which are engaged hand to hand lasts scarcely a moment. But each group of files formed by the action is bound none the less to the neighboring group; groups, like individuals, are always careful about their support. The battle is fought along the line of contact of the first rank of the two armies, a line straight, broken, crooked, bent forward or backward according to the varying

fortunes of the fight at various points, but always limiting and clearly separating the combatants of the two sides. In this line, once willingly or unwillingly engaged, one has to keep faced to the front under pain of immediate death, and each man in these first ranks naturally and necessarily exerts all his energy to defend his life. No part of the line becomes entangled as long as the real fighting lasts, for the object of each man, from general to private, is to preserve the continuity of support along this line, and to break or cut that of the enemy, for then comes victory.

We see, then, that between men armed with the sword there can be—and there is, if the fighting is serious—a penetration of one mass into the other, but never a confusion, an intermingling, a mêlée of ranks or of the men who form these masses. The fight of sword against sword was the most deadly and could show the most sudden changes of fortune, for it is the class of fighting in which the valor of the individual combatant, his courage, dexterity, coolness and swordsmanship, has the greatest and most immediate result. After studying this, the other forms of combat are easy to understand.

Let us consider pikes and swords. The lance thrusts of men in close order, a forest of pikes holding one at a distance (the pikes were 15 to 18 feet long) were irresistible. But one had leisure to kill everything—cavalry and light infantry—around the phalanx, a mass powerless to destroy, moving with measured steps, which a mobile body of troops could always avoid. Openings in the phalanx might be made by the march, by the terrain, by the thousand accidents of the fight, by brave men, or by the wounded on the ground who crawled under the breast-high lances to hamstring the men in the first rank. These latter scarcely saw them, since the men in the first two ranks hardly had room to see and to direct their strokes, consequently when the least opening had been made, these men with long lances who were useless at close quarters, and were prepared to fight only at the full length of their lances,* were struck down almost with impunity by the groups which had thrown themselves into the intervals. Then, with the enemy in its vitals, the phalanx, through fear, became a disorderly mass—mere sheep falling over and crushing one another under pressure of fear.

In a crowd, indeed, men pushed on too hard from the rear, prick with their knives those who are pushing them, and the contagion of

* Polybius.

fear changes the direction of the human wave, which recoils on itself and crushes itself into a mass in order to leave a vacant space around the point of danger. If the enemy, then, flies before the phalanx, there is no mêlée. If he only falls back for tactical reasons and takes advantage of the openings to penetrate the phalanx by groups, there is still no mêlée, no mingling of the ranks. The wedge entering a block of wood does not mingle with it.

In the case of a phalanx armed with long pikes against a similar phalanx, there was still less chance of a mêlée; but there was a mutual shoving which might last a long time, unless one side succeeded in taking the other in flank or rear with some detached body of troops. We see, moreover, that in almost all the battles of ancient times the victory is won by such means—means eternally good, since their action is moral, and the nature of man does not change. It is useless to explain again how and why, in all battles, demoralization and then flight began with the rear ranks.

I have tried to analyze the fighting of the infantry of the line, for it was the only serious fighting in the battle of ancient times; the light infantry put each other reciprocally to flight as Thucydides proves. They came back to pursue and massacre the conquered.

On cavalry (in the case of cavalry against cavalry), the moral impulse, represented by the speed and good order of the mass, had a very great effect, and we see that only infinitely rarely were two bodies of cavalry able to resist this effect. They did do so at the Ticinus and at Cannae—battles mentioned because they are rare exceptions. And even in those battles there was no shock at full speed, but a halt face to face and a fight.

Indeed, the meeting of whirlwinds of cavalry occurs only in poetry, never in reality. In the shock at full speed, men and horses would be shattered, and neither men nor horses wish it. The hands of the riders are there, their instinct and the instinct of the horses, to slacken the pace and to halt, unless the enemy himself halts, and to make an about-face if the latter continues to come on. And if ever they do meet, the shock is so lessened by the hands of the men, the rearing of the horses, and the drawing back of heads, that it is merely a halt face to face; they exchange a few blows of sabre or of lance, but their equilibrium is too unstable, their point of support too mobile for sword-play and for mutual support; each man feels himself too isolated, the moral pressure is too strong, and, though little blood is shed, the fight only lasts a second, just because it

cannot last without a mêlée and in the mêlée each man feels and sees himself alone and surrounded by the enemy. The leading men, who think themselves no longer supported and can no longer stand the uncertainty, wheel to the rear; the rest follow; and the enemy, unless he has also wheeled to the rear, pursues as he pleases, or until he meets some fresh cavalry which makes him fly in his turn. With cavalary against infantry, there was never a shock. The cavalry annoyed the infantry with its missiles, and possibly with lance thrusts delivered on the run, but it never closed.

To tell the truth, such a thing as close fighting on horseback did not exist. Indeed, if the horse, by adding so much to man's mobility, enables him to menace the enemy and to charge upon him at high speed, it also permits him to escape with like rapidity when this menace does not stagger the enemy, and man uses the horse, following the tendency of his nature and sound reasoning, to do the most possible damage with the least possible risk. To sum up, with cavalry without stirrups or saddles, for whom throwing the javelin was a difficult thing*, battle was merely a succession of mutual harassings, of demonstrations, menaces, skirmishing with missiles, where each side seeks an opportunity to surprise, intimidate, profit by disorder, and to pursue its opponent, whether cavalry or infantry; and then, *vae victis*—the sword does its work.

Man of all periods has the greatest fear of being trampled by horses, and, undoubtedly, this fear has overthrown a hundred thousand times more men than the real shock (always more or less avoided by the horse) would have or has knocked down. When two bodies of cavalry of ancient times wished or were compelled to fight in earnest, they fought on foot.† I scarcely see in all antiquity any case of fighting on horseback except Álexander's pasage of the Granicus. And what happens there? His cavalry crosses a river with steep banks defended by the enemy and loses 85 men—the Persian cavalry loses 1,000—and both sides are equally well armed!

The battle of the Middle Ages was a repetition (less the science) of the battles of ancient times. The knights came to close quarters perhaps oftener than the ancient cavalry because they are invulnerable; it was not enough to overthrow them—their throats must be cut when they were on the ground. They knew, moreover, that their

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* Xenophon.

† The Ticinus, Cannac, Livy's example.

fights on horseback were not serious in their results, and, when they wanted to fight in earnest, they fought on foot* The conquerors, clad from head to foot in iron, lost no one (the villeins did not count); and if the conquered and unhorsed knight was wounded he was not killed, for chivalry had come to establish a fraternity of arms among the noblesse, the mounted warriors of the different nations, and the ransom had taken the place of death.

If we have dealt principally with the fighting of infantry, it is because it is the most serious fighting, and because, whether on foot, on horseback, or on the deck of a ship, one always finds, at the moment of danger, the same man, and he who knows this man well can, from his actions here, infer his actions everywhere.

CHAPTER VI.

Let me repeat what I said at the beginning of this study: Man does not fight for the sake of fighting, but to gain the victory; he does everything in his power to minimize the former and to assure the latter. The constant improvement of engines of war is due to this cause alone—to destroy the enemy and to remain unharmed. Absolute bravery, which does not refuse to fight at a disadvantage, committing itself to God or destiny, is not natural to man; it is the result of moral cultivation and is infinitely rare. In the face of danger, the animal instinct of self-preservation always gains the upper hand. Man calculates his chances, and how wrongly does he calculate them? We have just seen.

Man has, then, a horror of death. With certain chosen souls, a great duty which they alone can understand and accomplish, sometimes makes them move to the front; but the masses always recoil at sight of the phantom. The object of discipline is to overcome this horror by a still greater horror—that of punishment, or shame. But the moment always comes when the natural horror is too strong for discipline, and the combatant flies. "Stop, stop! Wait a few minutes—a single instant more—and you are the victor! You are not yet even wounded—if you turn your back it means certain death." He does not hear—he can no longer understand. He is filled with fear to the exclusion of every other feeling. How many armies have sworn to conquer or perish? How many have kept

* Battle of the Thirty, Bayard, etc.

their oath? The oath of sheep to stand fast against the wolf. History records, not armies, but individual souls who have known how to fight to the death, and the devotion of the men of Thermopylae is justly immortal.

Here we are, back again at the elementary truths, by so many forgotten or unknown, which I have stated in my preface. Since real, serious fighting is the serious ordeal we know it to be, in order to impose it on a crowd of human beings it is not enough for this crowd to be composed of brave men, like the Gauls or the Germans. We must, and do, give them leaders who have firmness and decision of command arising from habit and a perfect faith in their imprescriptible right to command, consecrated by tradition, law, and the social constitution. We add good weapons, a manner of fighting suitable to these weapons and those of the enemy, and to what we know of the physical and moral forces of man; and, further, a rational subdivision of troops which makes possible the direction and employment of every effort down to that of the last man. We animate them with passions—the fierce desire for independence, the fanaticism of religion, national pride, love of glory, desire for gain—and a law of iron discipline, forbidding anyone to withdraw from the action, imposes solidarity from the highest to the lowest, among the various units, among the leaders, between leaders and soldiers, and among the soldiers.

And have we, then, a strong army? Not yet. Solidarity, that first and supreme force of armies, is, it is true, prescribed by the severe laws of discipline backed by strong passions; but to prescribe is not enough. A surveillance which nothing can escape during the action must, by insuring the execution of discipline, guarantee this solidarity against weaknesses in the face of danger—those weaknesses which we know so well—and to be felt and (what is most important) to exert a strong moral pressure and make everyone advance through fear or shame, this surveillance, this eye of all watching each one, requires in each group men who are sure of themselves and who understand it as a right and a duty for the common safety.

A wisely planned organization (and with that we must start) must, therefore, place permanently the same leaders and the same soldiers in the same groups of combatants, in such a way that the leaders and comrades of peace and the manoeuvre camp may be the leaders and comrades of war; in order that from the habit of living

together, of obeying the same leaders, commanding the same men, of sharing fatigues and recreations, and of associating with men quick to understand the execution of military movements and evolutions, may come fraternity, union, the sense of calling—in a word, the clear feeling and understanding of solidarity—the duty to submit to it, the right to impose it, the impossibility of escaping from it.

And now confidence appears. Not that enthusiastic and thoughtless confidence of disorderly or improvised armies, which lasts until danger appears and then fades so rapidly to make room for the opposite feeling, that confidence which sees treason everywhere, but that deep-seated, firm, and conscious confidence which does not forget itself in the moment of battle and which alone makes true combatants.

We have now an army; and it is no longer difficult to understand how men actuated by the strongest passions, even men who know how to die without flinching, without paling, really brave in the face of death, but without a strong organization, are conquered by others individually less brave, but organized with solidity and solidarity.

One likes to picture an armed mob overthrowing all obstacles, carried on by a breath of passion. There is more picturesqueness than truth in this imagination.

If battle were an individual work, the brave, passionate men composing this mob would have more chance of victory; but in a troop of any kind, once before the enemy, each man realizes that the task before him is not the work of an individual but a collective and simultaneous work and, surrounded by companions assembled at random the day before under unknown leaders, he feels by instinct the lack of union, and asks himself whether he can count on the others, a distrust which will lead him far at the first hesitation, the first serious danger which checks for a moment the enthusiasm of passion.

Solidarity and confidence cannot be improvised; they come only from that mutual acquaintance which is the basis of union, and of the point of honor. From these come, in turn, that feeling of strength which gives the courage to attack through the confidence of succeeding, the triumph of the will over instinct, the greater or less duration of which means victory or defeat. Solidarity, then,

can alone give us combatants. But there are degrees in all things—let us see if the battle of today is less exacting in this respect than the battle of ancient times.

In the battle of ancient times there was no danger except at close quarters. If a body of troops had enough morale (and the Asiatic mobs often did not) to advance within sword's length of the enemy, there was a fight. Whoever came to that distance knew that to turn the back meant death; for, as we have seen, the victors lose very few men and the vanquished are exterminated. This simple reasoning held the men in place and was able to make them fight, were it but for a moment.

Today (except when very rare and exceptional circumstances bring two troops unexpectedly face to face) the battle begins and is fought at long range. The danger begins at a great distance, and one must march for a long time in the face of projectiles becoming thicker at each step he advances. The vanquished loses prisoners, but often, in killed and wounded, loses no more than the victor.

The battle of ancient times was fought by groups crowded together in a small space, in open country, in full view of each other, and without the deafening noise of the weapons of today. The supervision of the leaders was easy, and individual weakenings were immediately suppressed. Only a general fright caused flight.

Today the battle is fought over immense areas, along long, thin lines, broken every instant by the accidents and obstacles of the terrain. From the time the action begins and the first shots are heard, men, scattered as skirmishers or lost in the inevitable confusion of a rapid march, escape from the surveillance of the leaders; a greater or less number conceal themselves and withdraw from the advance, and, diminishing by just that much the material and moral effect and the confidence of the brave men who are left alone, may cause defeat.

But let us get a closer view of the man in the ancient battle and in the modern. I am strong, quick, vigorous, skilled in arms, cool, and clear-headed; I have good offensive and defensive arms and reliable comrades who have been with me for a long time and will not let me be overcome without supporting me; I with them, they with me—we are invincible, even invulnerable. We have fought twenty battles and not one of us has fallen. We need only support each other in time and keep cool. We are on the alert to relieve

each other and to put a fresh combatant in front of a wearied enemy. We are of the legions of Marius, of the 50,000 who held their ground against the raging tide of the Cimbri, killed 140,000 and captured 60,000 of them, losing only 200 or 300 awkward men of our own.

Today, however strong, determined, skillful, and brave I may be, I can never say to myself: "I shall come back alive." I am no longer dealing with men—I fear them not—but with the fatality of gun-metal and lead. Death is in the air, invisible and blind, with terrifying whispers which make me bend my head. However good, however brave, however firm, however devoted my comrades may be, they do not guarantee my safety. Only—and what an abstract thing this is and how much less intelligible to all than the material support of the ancient battle!—only I imagine that the more of us there are to run a dangerous risk, the greater will be the chance for each one to escape; and then, too, I know that, if we are confident that not one of us will be found wanting in the battle, we shall feel ourselves to be stronger and shall be stronger. We shall begin the fight and carry it on more resolutely, and we shall get through with it sooner.

Get through with it! But to end it, we must advance and seek the enemy, and, infantryman or cavalryman, we are naked against the iron and against the lead, which cannot miss its stroke at a couple of paces. Even so, let us advance freely and resolutely. Our adversary will not stand before the sight of our rifle at point-blank range, for the charge is never mutual, we are sure,—we have been told so a thousand times,—we have seen it ourselves. But suppose things should be different today! What if he also should aim point-blank at us! What a difference between such confidence and the confidence of the Roman!

I have shown elsewhere what a difficult and dangerous thing it was for the soldier in ancient times to withdraw from the action. Today the temptation is far stronger, the opportunity greater, and the danger less. Today, battle requires a moral cohesion, a solidarity much closer than ever before. One last remark on the difficulty of directing the battle will complete my demonstration.

Since the invention of firearms—the musket, the rifle, the cannon—the distances of aid and mutual support among the different arms have continually increased. The facility of various kinds of communication makes it possible to assemble on a given

terrain forces which are numerically enormous. For these reasons, as I have said, battlefields are becoming immense. To take in the entire field becomes more and more difficult. Control, ever increasing in difficulty, because more distant, tends more often than not to escape from the commander-in-chief to the subordinate leaders. That inevitable disorder which a body of troops in action always shows, because of the moral effect of our engines of destruction, keeps increasing to such an extent that, in the midst of the tumult and fluctuations of the fighting lines, the soldiers often lose their leaders—the leaders their soldiers. Among the troops closely and strongly engaged, small groups only, squads or companies, if they are well organized, keep themselves in hand and serve as supporting or rallying points for men who have lost their way. Thus, by force of circumstances, battles tend today, more than ever before, to become soldiers' battles. This should not be so. That it *should* not be so we do not dispute, but it *is* so.

Perhaps one denies this, and makes the objection that the troops taking part in battles are not all either closely or strongly engaged; that the leaders always try to keep in hand as long as possible troops in condition to march and to move at a given moment in a determined direction; that today, like yesterday and like tomorrow, the decisive action is won by these troops in good order, appearing in such or such a formation, at such or such a point, and, consequently, the battle is won by the leader who knows how to keep them in hand and direct them. That is undeniable.

But no less undeniable is it that the more men the enemy is compelled to put into the line to oppose the troops closely engaged, the more chance there is for us to keep a reserve of troops in hand. The objection made, stating a general principle, true at all periods of history, is in no way opposed to the following truth: Among the troops which are doing the fighting, for the reasons I have stated (and they are true ones), the soldiers and the leaders nearest them, from corporal to battalion commander, have more freedom of action than ever before; and as it is the vigor alone of this action, independent more than ever of the direction of the higher leaders, which leaves in the hands of the latter forces which they can direct at the decisive moment. So this action becomes of greater importance than ever, and one may say, more truly today than ever before, that battles are the battles of soldiers and of captains. They are

always so actually, since, in the last analysis, the soldier does the work, but his influence on the final result varies. Thence the true saying of today: *Soldiers' battles*.

Aside from the rules of tactics and discipline, common sense shows the necessity for a reaction against this dangerous predominance of the soldier's action over the leader's—for postponing, by every means, to the last possible moment, that instant when the soldier escapes from the control of the leader—an instant which influences, every day more powerful, are tending to hasten. But the fact is there, and this fact and the uneasiness it arouses, together complete the demonstration of this truth. Battle, to return us the full value of our work, requires today a moral cohesion and a solidarity closer than ever before. So clear, that it is almost axiomatic, is the truth that the more bonds have to be stretched, the stronger they must be, if one does not wish them to break.

CHAPTER VII.

If there are other things to be learned from this work, they are left to the meditation of the reader. Their reduction to actual examples and treatment with the undeniable authority of fact must be based on a sincere study of modern battle, and this study cannot be made with nothing but the accounts of historians. These describe well, in a general way, the action of large bodies of troops. But this action in its detail and the individual action of the soldier, in their accounts, as in the reality, remain enveloped in a cloud of haze. And yet they must both be grasped, for their mutual accord is the justification and the basis of all systems of fighting, past, present, and future. Where are they to be found?

We have infinitely few accounts giving as near a view of battle as Colonel Bugeaud's story of the fight at the Hospital bridge. It is such narratives, even more detailed—for the least detail is of importance—of actors or of witnesses who knew how to see and who know how to remember, which are needed for a study of the battle of today.

The number of killed, the character and location of wounds, will very often tell more than the longest narratives, even when the latter happen not to be lies. One must learn how man (and of the genus man, the Frenchman in particular) fought yesterday; how and to what extent, under pressure of danger and of the instinct of self-preservation,

involuntarily and inevitably, he followed, despised or forgot the methods ordered or recommended, in order to fight in such or such manner, forced on him or indicated to him by instinct or by his knowledge of war.

When we know that, truly and without illusions, we shall be very near knowing how he will bear himself tomorrow, wielding or opposed to the weapons of today, so much more rapidly destructive than those of yesterday. Even now, from what we know of the past, knowing that man is capable of but a given degree of terror, and knowing that the moral effect of destruction increases in the same ratio as its power and its rapidity, we can foresee that tomorrow, the formal methods, to which the illusions of the target range and our neglect of our own experience seem to bring us back, will be less practicable than ever before; that tomorrow, more than ever before, we shall find predominant the individual worth of the soldier and of the small group and, consequently, of the stability of discipline.

The study of the past alone can give us a sense of what is practicable, and can make us see how the soldier, necessarily and inevitably, will fight tomorrow. Then, instructed and forewarned, we shall not be disconcerted; for we shall be able to prescribe in advance such methods of fighting, such organization, such preliminary formations, as may be suited to this necessary and inevitable manner of fighting, which will have the effect of regulating it as far as possible and, consequently, of doing away with chance to the greatest possible degree, by keeping longer in the hands of the leader the power of directing the combatants,—a power which is lost in an instant, when the instinct of the combatant is absolutely incompatible with the method ordered. That is the only way to preserve discipline, which is weakened by tactical disobediences at the moment when it is most needed.

But we must remember that we are dealing here with dispositions before action and with methods of fighting, and not with manoeuvres. Manoeuvres are the marchings of troops toward the scene of action and the movements necessary to dispose on this terrain the largest as well as the smallest units, with every guarantee of order and of the greatest possible speed. They are not the action itself. The action follows them.

It is the confusion between maneuver and action which leads in

many minds to a doubt and distrust of our regulation manoeuvres. These, considered altogether, are very good, since they give us the means of executing all movements and of taking all possible formations with the greatest rapidity and good order practically possible. To change or to criticise them does not advance us a single step. The problem of the final action always remains. Its solution lies in the sincere study of what has happened in the past, from which alone one can draw conclusions as to what will happen tomorrow—and then, all the rest follows.

This study has yet to be made—or, rather, to be written—for it has been made by all those leaders to whom experience of war has given a worth and moral authority recognized throughout an army, those leaders of whom it is said: "He understands the soldier and knows how to make use of him."

What more did the Romans know when they invented the legion? But how well they knew it, those masters of war! Only their incessant experience and profound thought could lead them to such a complete knowledge.

The experience of today has hiatuses; it must then be collected carefully, and this study which must be made will be good for that purpose, and also to stimulate thought, even among those who know,—especially among those who know. And, since extremes in so many things meet,—who knows,—whether, just as in the ancient days of battle with spear and sword armies were seen to conquer other good armies of twice their strength,—who knows whether the excessive improvement of weapons of long-range destruction may not bring back again those heroic victories, with equal arms, of the few over the many, by some combination of intelligence or genius with morale and artifice.

Even though the words be Napoleon's, it is hard to accept the statement that victory will always rest on the side of the heavier battalions.

ACTIVITY OF FIELD AND HEAVY ARTILLERY IN THE RUSSO-JAPANESE CAMPAIGN, AND THE INFLUENCE OF THE WAR EXPERIENCES THERE ON OUR USE OF ARTILLERY TODAY.

Translated from the German.

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This work is intended solely to assemble the many scattered details in the literature in order to direct the development of our present views on the basis of the experiences of the Manchurian campaign. Although it is comparatively easy in this age of commercial intercourse to follow the occurrences of a war, it is difficult to draw from them the correct conclusions, not to mention the danger of generalizing appearances due to local conditions, or to ascribe to matériel mistakes of the personnel, and *vice versa*. We find personal views always expressed in all reports, so that the representations of entirely unobjectionable and competent witnesses of the same occurrences and appearances are at great variance. How much personal views can differ is shown by the statement of the moral effect of artillery fire.

Lieutenant Colonel Bronsart Von Schellendorff in his paper "Experiences with the Japanese Army,"[1] writes as follows: "If I previously stated that after the first terrifying effect one quickly becomes accustomed to the whistling and bursting of the artillery projectiles, I can affirm on the contrary, that infantry fire has a most painful effect on one's nerves during the entire action without interruption." Quite a contrary view is expressed by Captain Solovies in his report to the French department, in which he writes: "One is soon accustomed to infantry fire, but artillery fire makes a far stronger impression."[2] A Russian officer expresses himself as follows: "Whoever asserts that shrapnel bursting overhead makes no impression on him does not tell the truth. The angry whistling in the air, the terrifying explosions, the humming

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[1] First number of the "Vierteljahrshefte für Truppenführing und Heereskunde" for 1906 (page 62).

[2] "Artilleristische Monatshefte" 1907 (page 322).

and striking of the bullets on the ground shatter even the strongest nerves."[3]

The views concerning the universal role which artillery played in the East Asiatic war are just as divergent. In the abovementioned French report it is further stated: "Although the occurrences of the war in Manchuria are not yet known in detail, the character of the battles show that the significance of those weapons is much increased."

Let us inquire now in detail what old ideas of the use of artillery in campaign have been confirmed and what new knowledge we have gained.

Baron Von Tettau writes concerning his journey to the theater of war: "We were more and more convinced 'that the Russians have never been willing or able to leave this country,' yet one will not sink untold millions in a country and then withdraw." He then speaks of the commissariat station built in Buchatu, in whose mess hall 1,000 men could be fed at the same time. Russia had thus begun to make herself at home in Manchuria and had not counted on accomplishing this without a struggle. What had Russia done for its artillery?

Russian and Japanese Field and Mountain Artillery.

Shortly before the beginning of the campaign Russia had introduced a new field gun, the Putilow gun, M. 1900, a quick-firing piece with recoil cylinders, but without a shield. In addition to many other shortcomings (for after each shot relaying was required) the chief defect of the piece lay in its extraordinary weight, considering the local treater of war.

Certainly a field piece is better in many respects if great weight can be disregarded, and for Russia's broad plains this gun might be sufficiently mobile; but in no way was this the case in the theater of war in Manchuria. Not only should the situation of a country regulate the introduction of a field gun, but the possible foreign theater of operations should be considered. Since Russia had decided not to give up Manchuria without a struggle, she should have considered with the introduction of a new field piece, the extremely difficult, mountainous terrain of that country. This disregard was made uncomfortably evident in the campaign. For

[3] Number 70 (page 24) of "The International Review for the Armies and Navies, 1906."

example, Von Tettau states, "The new Russian field piece proved much too heavy for the mountain warfare. When once in position it was withdrawn in the face of fire with the greatest difficulty. The difficult places in the mountain roads could be overcome only with the greatest efforts." * * * "With the assistance of the infantry both batteries were hauled over the pass after an hour and a half. The already heavy guns as well as the ammunition wagons were loaded with 7 poods of oats[4] and all sorts of other baggage. Had the column been attacked on the march, the artillery would not have been ready for fighting." Again in similar vein, "Although the detachment possessed but one battery with the right column, the march on the preceding days had shown that it was only a hindrance to the advance of the column."

Thus the artillery could not follow the infantry on the march, but had to be helped forward by them. As a result, the whole artillery was not brought along, and at length that which had come was sent back for fear that in a possible retreat it could not follow, and would fall into the hands of the enemy.

The emplacing of the guns in this mountainous terrain was as difficult as the march. For instance, Von Tettau states, "The pieces were transported half way up the mountain side by ten horses, then dragged up by the infantry with ropes. The slope was so steep in places that one gun at its first shot rolled all the way down the mountain." Undoubtedly, guns so placed fell into the hands of the enemy very easily. As a matter of fact, a battery similarly emplaced at the pass of Pagou became a prize of the Japanese. It was due in part to the enormous weight that the Russians lost so many guns to the enemy.

It will thus be seen that the Russian field gun was in no way suited for the campaign in Manchuria as far as its mobility was concerned. If Russia would not or could not obtain a lighter piece, one would think a larger number of mountain batteries would have been provided; but not at all. At the end of April, 1904, only one old mountain battery was to be found in the entire army. Only at the beginning of the campaign were 18 batteries (108 quick-firing mountain guns) provided. This lack of mountain artillery made itself doubly evident owing to the heavy guns, and also to the lack of machine guns. For instance, Hamilton

[4] 1 pood=36.07 pounds.

says, "A division[5] of artillery would have immeasurably supported the attack of the Russians, as also in case of a retreat they would have been of the greatest utility."

These insufficient preparations for a mountain campaign were recognized especially after the arrival of the mountain artillery. The mountain guns which had been ordered arrived slowly. Thus at the time of the Battle of Shaho, in which the Russians could have used them to great advantage, we find 16 quick-fire mountain guns besides 14 old ones, and this in an army of over 250 battalions with 760 guns, an entirely disproportionate number.

The Japanese field gun, Arisaka Model 1898, was not a modern quick fire rifle. The recoil of the carriage was not entirely obviated, and the breech-block required two operations. Its height and weight caused it to be better adapted to operations in Manchuria than the Russian artillery, for the Japanese had experience in Manchuria in the Japanese-Chinese War. The Japanese army was also well supplied with mountain artillery, 162 mountain and 540 field pieces,[6] the advantage of which was felt, not only in the mountainous region, but in time of bad weather. The character of the theater of operatons was thoroughly considered.

Ballistically, the Japanese field piece was far inferior to the Russian on account of its older construction and lighter parts, so that the Japanese themselves admitted that the Russian half-battery of four pieces possessed the same value of the Japanese battery of six pieces. This was also felt in the rate of fire, which, for the Russian piece was 15 to 20 shots, and for the Japanese 10 shots per minute. Furthermore, this was felt in the number and weight of shrapnel bullets, but above all things, in range. Russian shrapnel attained a range of 5,500 meters, the Japanese only 4,300 meters. This was uncomfortably evident when the Russians fired from distances which could not be reached by the Japanese. On account of the slight effect of shell on living targets, this projectile was only a weak substitute for shrapnel. Long range shrapnel must remain one of the principal requirements of field cannon.

The Russians had supplied their artillery with a sufficiently modern, effective gun, but they had overlooked the fact that the effectiveness depends not alone on the material, but also on the knowledge of the piece and ability on the part of the troops and

[5] A battalion is intended.

[6] Supplement 70. Revue.

their leaders to use it properly. This was by no means the case with the Russians. Von Teil says, "The artillery shortly before the war had exchanged their old field pieces for the new rapid fire cannon; the majority of the batteries had fired them only once, and some not at all. Most of the artillery commanders and nearly all the higher commanders had had no experience with the mechanism and use of the new weapon." * * * "Also, the artillerymen were not familiar with the new rapid fire piece, and after the battle (of the Yalu) one heard on all sides the desire expressed to get back the old piece. Of concealed positions and indirect fire they knew nothing."

A Russian general of artillery has this to say:[7] "The unknown cannon of our artillery, the unknown range of our gun, the unknown method of conducting the work of batteries by their commanders from a distance, were shown by the errors of the war. Everything new, everything different from what one had to work and learn in peace." For this reason, the Russian artillery did not accomplish what it should, especially in the first stages of the war.

But not only the weapons of the artillery, but the organization itself was likewise partly new. Von Teil writes: "Shortly before the war the two artillery brigades in Eastern Asia were dissolved; each of the East Siberian brigades received an artillery division of three batteries. After the outbreak of the war the divisions were changed into brigades by the addition of a fourth battery (after the European corps). These measures naturally did not increase the efficiency of the troops, and made itself evident during the campaign, especially in the artillery.

On the Japanese side a similar mistake of changing at the last moment was made. According to the "Artilleristische Monatshefte," the fire control had been changed just before the war. Perhaps that is the reason that in the first battles of the war the effect of the Japanese artillery was not greater.

When war is threatened we should demand that all changes in matériel, organization and plans be limited, in order that the effectiveness of this arm will not be prejudiced, and that such a change will be justified. Change of fire control can become a two-edged sword. The value of different methods is not much at variance, and the troops should use the system to which they are accustomed.

[7] Artilleristische Monatshefte, 1908, page 110.

If this is true of active officers, it holds so much the more for reserves and militia. General Langlois estimates five or six years at the time necessary for German battery commanders to attain the same familiarity in tactical and technical use of the new field piece as the French now possess.

Technical Use of Artillery

How was the artillery used in this war and what results follow its employment? We will speak first of the technical side. In Von Teil (Vol. 1, page 87), the following is written of battery positions in the battle of the Yalu: "They were on the highest point, as were all Russian fortifications during the first part of the war, visible from a great distance, and fine targets for the hostile artillery." Further on page 99: "The few batteries stood high on the mountains, in emplacements visible far off, and were quickly silenced by the widely scattered hostile artillery." A Russian opinion of this is expressed in "Streffleur" (1907, page 911), where it is stated: "Our commanders chose especially exposed positions for the artillery, even on the sides of mountains towards the enemy. Of four positions prepared for the —th battery at Haitschen in the first half of May, two were on the exposed slopes."

The result of these exposed and widely visible battery positions was the quick defeat of the Russian artillery, because in the first conflicts, the Russian was considerably inferior in numbers to the Japanese artillery. This was also the case compared with the number of rifles. According to the Artilleristische Monatshefte (1908, page 104), the Russians had three field pieces for each 1000 rifles, the Japanese four and a half. In the same place, according to V. Lobell's annual report for 1904, there were 40 Russian field pieces against 108 field guns and 24 howitzers at the Yalu, at Kintschou 24 Russian field and 55 heavy guns against 216 guns of the army and 30 of the navy, and at Wafangou 94 Russian guns against 198 Japanese. These numbers may not be accurate, but show the approximate relative strength in field artillery.

As a result of this quick defeat and also an increased knowledge of the new material, the Russians commenced to fire from concealed positions, something that General Kuropatkin himself ordered on August 28, 1904. Besides the decrease in losses, these concealed positions would have given the Russians the opportunity to employ more artillery.

Von Teil says of the Battle of Lagoulin (Vol. 1, page 218): "Only these 16 guns out of the 83 field pieces of the corps took part in the battle. The remaining 72 were sent to the rear, since the commanding general thought there were no suitable artillery positions. I believe more batteries could have been used if they had ridded themselves of the custom of always placing their guns on the heights. The employment of a greater number of guns might have changed the result of the battle."

The artillery, in its efforts to conduct its fire from concealed positions, encountered not only little support from the leaders, but even opposition. Gradually they were convinced that guns could be fired from concealed positions. Thus a Russian officer writes according to "Streffleur" (1907, page 912), that he had won not only the battles with the Japanese at Liaoyang, but also with all the higher leaders, officers of the general staff and conservative artillerymen who would not comprehend what the traversing circle is, and what a change it brings in the selection of positions for batteries. He continues, "Now, on September 24, they no longer hindered the choice of positions."

Thereafter, firing from concealed positions was adopted more and more in the course of the campaign, but was occasionally faultily used. A concealed position is advantageous in order to decrease the effect of hostile fire, to secure better stations, and to use more artillery, so in future we may count on concealed positions almost entirely. The artillery duel is not, however, its proper realization of such positions. Artillery must be employed to support the main objects. Whether or not the position is concealed or open, the tactical situation must be preserved. Artillery must select the position which will be of benefit to all, and not one that would keep itself intact, and useless to the Infantry. The motto of the artillery in this respect must be: "Sacrifice yourself if you must and save yourself if you can."

Even if firing from concealed positions can be made, by improvement in fire-control, as effective as firing from open positions, various disadvantages of this course still remain, such as lack of personal influence of the commander on his battery, failure of communications from distant observing stations, and necessity for more room. Nor will it always be possible to find suitable concealed positions for assembled batteries, especially if battle fronts are as extensive as they were in Manchuria. For this reason part of the artillery will

be compelled to fire from open positions, for we cannot send guns to the rear, as the Russians did, because there are no suitable concealed positions. The use of field artillery will always require that position from which the infantry will be supported, but due to improved material, especially in fire-control, this position will usually be concealed. If open positions and direct aiming are still to be practiced, the greater the difficulties of firing from concealed positions, the more we must practice their use in peace maneuvers, so that we may become masters of these difficulties. Advancing technics can help us overcome these difficulties. Improved fire-control must give us a quick and sure opening of fire, laying from distant observing stations, and utilization of the great range of modern cannon. Complete communications must render secure a certain fire direction. At length, by means of portable observing ladders on limbers and ammunition wagons, and binoculars, the distance between firing and observing positions must be decreased and the sight elevated from the battery.

The result of destructive fire against batteries in exposed places has caused the general introduction of protective shields. Their adoption has been remarkable, since the great mobility of the field gun has remained. The necessity for a protective shield was noted by both leaders in the course of the campaign, and they sought to make good this need. The Japanese, after the battle of July 31, 1904,' constructed protective shields of hard wood, with which they were well satisfied, according to "Streffleur" (1907, page 643). The Russians, in the course of the campaign, introduced a battery with a new carriage provided with shields. Although actual experiences are lacking, tests in peace demonstrate that exposed batteries with shields can withstand the fire of field artillery. These shields enable the cannoneers, especially the gun pointers, to persevere under the hottest infantry fire, and permits him to remain behind this protecting shield for all operations. This will suffice for the technical use of artillery.

Tactical Use of Artillery.

As already mentioned, the Russians were inferior in the number of guns in the first battles of the campaign. For various reasons this condition became more unfavorable for the Russians. The

* Yang-tzu-ling—Yu-shu-ling.

fact that the Russians did not employ their batteries because of technical reasons has been mentioned, for they asserted that they were unable to find positions. Moreover, strong artillery reserves were habitually held back, and they always entered the fight too late, if at all. During the entire campaign the Russians were unable to free themselves from these artillery tactics. Even in the army order of January 9, 1905, General Kuropatkin accentuated the separation of strong artillery reserves. A third reason for the Russians holding or sending back this artillery was the constant apprehension of losing guns. Von Teil says about Anpinlin: "The purpose of the commanding general to use more than three batteries against the hostile attack" (there were 14 batteries available) "was opposed by the commander of the artillery who was afraid of losing his batteries by a flank attack of the Japanese. Since the battle of Tiurentschin they were in constant fear of losing guns, and gradually they came to realize that a great part of their lack of success was due to this careful sparing of the artillery."

As a natural consequence of such views only a small part of the Russian artillery was ever employed. At Lagoulin, for instance, only 16 of the 88 guns and at Anpin only 8 of the 14 batteries of the Tenth Corps were put into action. We learn about the Battle of Schaho from Von Teil who wrote: "While the artillery division of the advance guard (two batteries) was destroyed before our eyes, 48 guns of the Ninth Artillery Brigade were held in the reserve. But something even more remarkable occurred.

General Riabinkin had, himself, always held one battery in reserve. About noon I saw to my great astonishment that this battery started to move. General Riabinkin sent it back, saying "I can have no use for it." So we see that in almost all the battles, as later we see at Liaoyang, the Russians were absolutely superior in artillery to the Japanese, but employed less of it in action than their opponents. Thus the Japanese succeeded in equaling the Russian artillery, for they always used all they had, and thus by force of numbers overcame the ballistic inferiority of their guns.

After the introduction of the protective shield, the artillery duel became of longer duration, for the fighting power of artillery decreased but gradually. Nevertheless, the withdrawal of an artillery reserve is unthinkable, for fear of betraying one's position. We must always maintain the principle of introducing artillery

early in the game. Certain it is that the introduction of a greater number of guns could have given a different turning to the battles in the East Asiatic war.

Details of the Technical Use of Artillery.

Let us now examine these conditions in detail. Since in the future we must still count on exposed positions, at least in the defense, the greatest value must be placed in good concealment, such as painting the gun grey, covering it with cloth or straw, and skillfully employing features of the landscape (as the Japanese did) in order to make it difficult for the enemy to discover and fire on the battery. The Japanese who generally used exposed positions (their regulations for field artillery of December 8, 1906, state, "direct fire forms the rule," and elsewhere "on taking a concealed position it is advisable to prepare one also for direct fire"), according to all reports, understood this art from the beginning. A case at the Yalu cited by Hamilton shows much care and trouble was exercised to attain this end. On page 69 we learn, "Much trouble was taken to hide the position from view of the northern shore. Trees were planted a short distance in front of the batteries to conceal the betraying fire from the muzzle. They were carefully selected from trees which grew just in front or behind the embrasure. Thus on the next morning the lanscape appeared unaltered to the Russians for they could not notice of course that a tree had been moved forward or back 200 or 300 paces during the night. The earth thrown up from the deep embrasures was carefully leveled so that no irregularity could be perceived in the landscape. Ditches were built to the river so that they should have enough water to moisten the sand near the muzzles, for otherwise it would have been whirled up by the firing and betrayed the position."

Similarly Hamilton states: "As usual all possible preparations were made most carefully to secure this advance without delays and unnecessary loss of life. Paths were cut through the high corn, epaulements and splinter proof structures for the men serving the piece were built, a place for the team indicated to the rear, great piles of wood erected to shield the cannoneers during their activity—in short, nothing was neglected to conceal from view. A Japanese officer told me that the next day he had crossed over the Shisan and from there could not discover where his own guns

had stood, and he was an artilleryman. The consequence was that both batteries on the right flank did not suffer a scratch in either personnel or material during the entire artillery duel which lasted from 7.10 a. m. till dark. The mountain battery on the right flank had to ride through the Sha-Ho to get to this position, and even Japanese cleverness could not improvise concealment over flowing water. A single Russian shrapnel struck down 14 men in the middle of the stream and killed a large number of horses. The artillerymen of the 2d Division stated positively that the 12th had offered no favorable target to the enemy at less than 4000 paces. A battery must have been destroyed which made such an attempt." The Russians, too, learned in the course of the war to emplace their guns very cleverly. Hamilton says of the Russian artillery position in the Battle of Yoshirei: "The Russian artillery was completely concealed. A better position could scarcely be conceived of."

The position of the batteries was often betrayed only by the sound, and the flame at the muzzle, and often, too, by the whirling clouds of dust after each shot. In Von Teil (Vol. 2, page 76) it is said of two batteries in the Battle of Sha-Ho, that in spite of or rather because of the fact that they were so deep in the earth that the chase lay right on the ground, they were easily discovered and firing on them by the Japanese simplified, because on account of the dry ground every shot raised a cloud of dust. Hamilton makes this remark: "They (the Russian guns) were placed in emplacements, while cover was lacking for the cannoneers. Nor did they attempt indirect fire, so that each gun could be immediately located by the flame at the muzzle and the large cloud of dust which every shot caused." They corrected this mistake later by wetting down the ground in front of the guns or covering it with mats.

These clouds of dust should be carefully avoided in getting into position in dry weather, not only in open but also in concealed positions. If the artillery could get rid of the extreme haste to fire the first shot, conditions would be improved in most cases. The difference in time would not be lost, for a more careful reconnaissance could be made and the time between the first shot and effective firing would be decreased.

In order to avoid or at least diminish these disadvantages of open positions which almost do away with the advantage of smokeless

powder, attempts to diminish the flame at the muzzle and to decrease the report should be continued above all things. Could these problems be satisfactorily solved the artillery with its protective shield could commence firing from open positions, and continue for a longer time.

With the growing use of the spade, which we must demand above all else after the introduction of protective shields for open positions, we must take care that we are not affected as an eye witness depicts in the "Militar Wochenblatt" (1905, Sp. 1597): "I have seen that entrenched mountain guns could not be used in a critical moment of the battle as they had to be turned, and this could not be done." Hamilton also condemns the same thing. He says: "Doubtless the Japanese guns are entrenched too deep. Consequently they are immobile, like fortress guns. It takes too much time to get them in and out of their position."

This concealment from view must extend not only to the batteries, but to the observing and commander's stations. Every observer of the war reports how unconcealed or carelessly concealed observing stations drew the enemy's (Japanese) artillery fire upon it as upon every group of infantry or cavalry. The greater the distance between battery and observing station, the more difficult it becomes to replace personnel and material, and concealment must be more carefully sought, so that in case of disaster to the eyes of the artillery, the usefulness of batteries will not be impaired.

It will not suffice, however, merely to conceal the observing stations from view. Protection of the entire personnel by shields or armored ammunition wagons, together with folding observing ladders which the Japanese employed advantageously, should always be provided.

For the manner in which batteries can be placed in open positions for sweeping the near foreground, a valuable instance is offered in "Streffleur" (1907, page 630), concerning the defense of Terra Yama Mountain in the battle of Shaho.

In order to lessen the effectiveness of the enemy's fire, various forms of masks and devices played a great role. The Japanese first showed themselves masters of this practice, but the Russians followed suit with equal advantage. Ullrich states: "Trunks of trees were placed between the wheels of Chinese carts and covered

with a cloth, as the Russian artillery usually was, to hide the glitter. These well-marked "guns" were placed 500 meters from the real position of the battery, and drew the Japanese fire without endangering the real artillery." Besides artistic hedges which served to conceal the advance, rifle pits, and batteries firing blank charges were used to deceive the enemy, which actually in the beginning drew the fire on themselves. Further, we find at great distances, open batteries whose purpose was to betray to the already emplaced and hidden artillery, the enemy's artillery positions. Against these latter deceptions the Russians later used a range finder successfully. Hamilton mentions a bridge at the battle of the Yalu whose sole purpose was to draw Russian artillery fire.

Further means of weakening the effect of or limiting the enemy's fire, were the great intervals between single pieces, the Japanese guns having about 24 meters. Instead of the long connecting lines of artillery hitherto employed, single and widely separated groups were now used, and were naturally more difficult to discover than the former lengthy lines. Furthermore, positions for concealed batteries with large interval between them were chosen behind hills. The effect of the enemy's scattered fire was thereby reduced, and was even further decreased by a frequent removal of the guns from place to place.

These then were the measures adopted to weaken the effect of the enemy's fire. Measures which should bring one's own fire to its maximum value belongs to the subject of fire control. The difficulty here had previously grown on account of the number of guns under one command, but now it grew with the distances between guns and groups of guns in concealed positions. By the introduction of means of indirect laying, which may also be used advantageously in open positions against small and barely visible targets, observing stations have become indispensable. Every artillery leader seeks first the most favorable point from which he can observe, and then the most favorable tactical and technical positions for his guns. The compromise between both demands has thus more or less disappeared. It is all the more necessary, under all circumstances, to have safely working communications between battery and battery commander, as well as between the latter and higher artillery commanders.

Telegraph, telephone, flag signals, mounted and dismounted messengers, and men to pass the word along can be used as means

of communication. The views concerning the advantages of the different communications differ. Their use will vary according to the distance the message must be sent. The last means may suffice for short distances, but every field battery should be equipped with telephone and flags for great distances, one being employed in case the other breaks down.

This fire-control within the artillery was practically unknown to the Russians, with whom the activity of the artillery was mostly confined to single batteries. In "Streffleur" (1907), a Russian officer states: "What we have to learn from the Japanese is conduct of the artillery in battle. With us the batteries, as soon as they are in position, fire against targets they see, and work independently the whole day, whereby they often do not know the purpose of the battle."

It has already been pointed out that as a result of the increased battle fronts the position of artillery has been changed. While formerly there was a long line, there were now even more extended positions, but there were greater intervals between groups of guns and perhaps more than one line. If this possibility of extending continues in the future, considerable advantages counterbalance the disadvantage of difficult fire control. Besides the desired decrease in the effectiveness of the enemy's fire, this position renders possible a concentrated fire, and frequently enfilading and flanking fire. Enfilading fire is of great importance against batteries with shields, since it attacks them on their weakest points, the sides. The advantage of flanking fire to sweep dead space due to the concealed positions was quickly discovered. In both cases shrapnel can be used effectively. Against this fire, the shield would merely delay the fall of the battery, but not prevent it. The Japanese valued flanking fire so highly that they detailed special companies to attack such batteries. Besides these advantages, grouping the batteries facilitates the movements of the infantry, which the former line of artillery greatly hindered.

On account of the changed positions of artillery, communications and fire control must be more carefully arranged than was formerly the case. Concealed positions, separated groups, and advanced observing stations cause a far different method of superintendence than was the case with a connected line of artillery at the same elevation and using direct fire. In order to make the most of these circumstances, cross-fire is often employed. On the other hand,

the rapid-fire gun has facilitated fire-control in that the increased rate of fire of one battery has rendered the grouping together of several batteries not so frequently essential as formerly the case. The difficulties of fire control increase with the firing of several batteries at a small target, and instead of increasing the effectiveness of fire, there is often a decrease.

There are exceptions to the rule that usually unified fire-control is essential. For example, it might be advantageous to assign artillery to a separate infantry brigade for a flank movement. It is better for the artillery commander to have no more influence on these batteries, for if the infantry attack fails, it can not be supported by the main line of artillery.

The more the emptiness of the battle-field increased during the course of the war, due to the fact that the artillery retired behind hills and the infantry intrenched, the more the service of information grew in significance, and its difficulties increased—difficulties which were accentuated by the many forms of deception practiced. Here, a new activity arises, and good telescopes must be provided for the observing stations. Not only will the concealed targets be difficult to find, but the unconcealed infantry, with their service uniform hardly distinguishable from the landscape, will add to the difficulties. According to reports the Japanese had modern equipment; the Russians secured good telescopes for the first time during the campaign.

It is especially typical of the Russians in this war, that at the beginning they lacked both training and equipment, and that at the end of the war they reached a point they should have attained at the beginning. That their artillery learned much during the war is shown by the description of the arrangement of an observing station in the battles of March, 1905.

Ullrich states (page 163): "A telescope with Zeiss prisms was placed on top. The distances to this side of the river, to the streets out of the village and to the single wooden bridge over the river were measured by riding, since the maps offered no reliable data for determining ranges. On a white table, which stood beside the telescope, the designations of the targets and range were written in figures and letters 10 c.m. high, in order that they could be read at night by the light of a match."

Since concealed batteries are often betrayed only by the report

of the firing, all means which contribute to their concealment should be adopted. It is a great help if one can say: "they can not be placed there." Consequently more attention must be devoted at our maneuvers to map study, so that one may judge the nature of the land without actually seeing it. There are all sorts of data on the maps, such as steepness of scarps, woods, fields, ditches, etc. It is obvious that sufficient maps must be on hand to give useful results, and these the Russians lacked. We learn how little preparation the Russians made in this respect from Von Teil. General V. Stackelberg, the leader of the Eastern Division, writing of the battle of the Shaho, in which this division had the very important and difficult mission of making a turning movement through apparently impassable mountain country, states that he wrote to General Kuropatkin: "The maps of the district for the advance are merely a white spot and contain only a sketch of one road leading from east to west, without any indication of relief, while actually the country, through which we have to march, is unusually mountainous and will be hardly passable for field artillery. In case there is a staff map of this country, I ask you to send it to me." A better illustration of the lack of preparation of the Russian Army for the campaign in general can not be conceived than this letter of the commander of an army composed of three army corps.

This map study can then be supplemented when the batteries themselves are fired on by the determination of the enemy's line of fire and the distances by the fuze heads of exploded projectiles. This practice is attributed to the Russians.

All these means, however, will not often suffice in order to obtain a useful result. The activity of the artillery scouts, who will operate both with the advancing infantry and on the enemy's flank, either alone or with the cavalry, must now come into play. They sometimes occupy fixed positions on advanced flank or high points, communicating when possible by megaphone or signals, and sometimes they act as patrols who must remain in contact with their own troops by messenger. These scouts were used advantageously, both by the Russians and the Japanese, especially successfully by the latter. I mention here the examples in "Streffleur" 1907, where the conjecture is made that the clever ranging of the Japanese, which the Russians ascribed usually to Chinese spies, in

reality is to be traced to the genius of the Japanese scouts. This was a genius which must have seemed wonderful to the dull Russians, especially if, as reported in the before-mentioned article, Japanese scouts tapped a Russian telephone system in order to learn the position of the Russian batteries.

These scouts will become even more necessary in the future, when we must deal with longer battles, as the decisive battles of a day have become more infrequent. In this case information will seldom arrive too late, and it will be worth while drawing the best personnel and horses away from the field of battle so that they may act in this service of information.

It will not always be easy to determine whether or not a position has been abandoned. In order to ascertain this fact artillery fire should first be employed against the enemy and if he fails to answer it, commanders must advance thin skirmish lines. It is the duty of commanders to use the activity of the other arms as much as possible. It is one of the primary duties of cavalry patrols to report the positions of concealed batteries. Infantry officers' patrols are excellent means of securing information, as the experiences of the Japanese abundantly proved. Thorough information of the battle-formations of different arms must be possessed by officers of infantry and artillery so that they can co-operate.

Airships and aeroplanes can be used successfully for the discovery of concealed batteries. Even if observations from balloons are of doubtful value, especially considering the number of guns firing, the discovery of concealed batteries can very easily be accomplished by trained observers. It consequently appears advantageous to provide the artillery with airships and aeroplanes and also trained artillery officers for them.

As already mentioned, artillery scouts should advance with the firing line in order that the artillery can fire on targets visible only from that vicinity, and in addition, to keep in constant touch with the infantry. The Russians deplore the lack of this relation between the two arms, which showed itself absolutely essential in the East-Asiatic campaign. More than once they fired on their own infantry because the artillery could not distinguish friend from foe. Places were fired on by the artillery, although they had already been taken by their own infantry. On the other hand, the infantry often commence retreating without informing the artillery in their rear. An especially stupid example of the last case

happened at the battle of the Shaho, where, due to lack of co-ordination between infantry and artillery, three batteries of the 10th Corps were captured by the Japanese. General Dekinlein reported the same case to the Minister of War (Streffleur, 1907, page 930): "The 3d brigade lost 24 guns, and the 9th just as many. How this can happen, one can not say absolutely, but in my opinion the fault is in the lack of co-ordination between artillery and infantry. They all work independently. No one knows what the other is doing."

This co-operation between the two arms was better attained by the Japanese, according to eye witnesses. With them, one arm always supported the other. General Stoessel writes in his report to the minister of war (Streffleur, 1907, page 930): "In order to avoid firing on their own troops, the Japanese used a signal device so that they could continue shrapnel fire during the entire advance of their infantry, and interrupted it only when a flag was shown at the very last stage of the advance. Each battalion carried a large flag and each company a small one of these national flags which had the picture of the rising sun of Japan on them. Flags of this sort have already been introduced in the English Army. These signals to cease firing can be given by the usual signal flags, and perhaps better since such flags could accomplish these tasks easier, more quickly and more surely. At all events, if firing on hostile positions by the artillery is to continue until just before the charge, a sure and safe method of communication must exist between the most advanced line of infantry and the artillery.

The artillery must also be in constant communicaton with the higher commanders so that its fire may always remain in harmony with the purposes of these commanders, and may be used against certain points with advantage to all. A commander must always be in a position to inform the artillery commander of the results obtained, of new reports and the like; he must be ready to unite superior fire against batteries hindering the advance of the infantry; finally, he must be in a position to have the mass of the artillery attack the point of assault.

In this respect the Russians failed many times, as the various examples noted in "Streffleur" (1907, pages 927-929) would indicate, thus showing the lack of communicaton between artillery and other commanders as the source of part of the failures. On the

other hand, the Japanese laid great stress on the relations of the infantry with the artillery.

While there is a great choice of means of communication between battery and battery commander and lower units, the telegraph and telephone are usually the only means of communication between advanced observing stations and battery commander, and also for communication with higher commanders. Besides disturbances of these lines within the firing line, there is some doubt if they can be emplayed in future, due to the extensive battle fronts. Wireless telephones and telegraph as well as heliograph signals will be used advantageously in this case. Signals and wireless telegraphy were used with success by the Russians in the campaign even though not used by the artillery.

With the question of the co-operation of the artillery and infantry, arises also the question of accompanying the infantry attack with part of the artillery, and also the question of changes of position. An anonymous English article in the "Artilleristische Monatsheft" (1908, page 106) states: "Changes of position by day will be avoided as much as possible by both sides, since even at great distances shrapnel fire must have disastrous effect against so favorable a target as a moving battery. Frequently the artillery will have to wait for dark before they can effect a change of position." Changes of position can accordingly be made under cover of darkness after preparations have been made for them during the day.

Change of position becomes even more difficult within the effective range of rifles and machine guns. No matter how difficult and dangerous it is to accompany the infantry attack, on account of the moral effect at least one battery should be detailed for this duty. Possibly batteries from the reserve artillery which have not been under fire, and which will have greatest freedom in choice of time and direction, should perform this duty. Detaching batteries already in the firing line is very much more difficult. Sufficient artillery must consequently be retained for such special missions. One should consider whether a change of position is likely to be justified by the results.

In the East Asiatic war, the accompaniment of the infantry attack by the artillery was not well done. The Russians were on the defensive, so did not attempt it, and the Japanese in the beginning

apparently did not value it highly. In "Streffleur" (1907, page 637) it is reported that the Japanese First Army seldom used the artillery to accompany the infantry attack, in spite of favorable cover, although perhaps they were prevented by the difficult terrain. In addition, poor arrangements for pulling the artillery may have contributed to this. Hamilton writes on page 269: "Some Japanese batteries exerted themselves in vain in the sticky mire like flies in buttermilk. Another proof, if one is required, that the Japanese guns had too few horses." Similarly on page 278, it is stated: "Because their badly pulled guns were unable to cover the ground and come to their assistance." Later it appears that the confidence of the Japanese increased, and apparently the infantry themselves demanded it. Mountain guns were far better for this purpose as they did not offer so favorable a target and were not so visible. They went up to withn 1,100 meters of the enemy, although the fuse of the shrapnel was good for 3,000 meters. It is also reported that the Japanese at Mukden accompanied the attack with guns drawn by men. Since, as a rule, these last changes of position can not be made at night, the construction of special motor cars for advancing guns and ammunition wagons, on which the manning detail could find shelter behind shields, would be very valuable. (Cf. Artilleristische Monatshefte, May, 1907).

Effect of Artillery Fire.

The different valuations placed upon the moral effect of artillery fire have already been mentioned. That this is inseparable from the material effect will now be more closely shown by investigation. It has already been stated that the effect of artillery in this war was regarded by some observers as very slight, but in this case they were wrong.

The influence of a weapon is shown most clearly when the enemy lacks the same arm. In Hamilton we find two instances. On page 224 it is reported of a Japanese attack at Liao-yang: "Not satisfied with a mere repulse, two of these baby cannon (mountain guns) went forward, and offered a striking demonstration of the overpowering might of artillery when not opposed by artillery." And on page 233 it is stated of the Russian retreat at Amping: "Many Russian batteries covered the retreat with their strong fire. This is another example of the influence of artillery when not

opposed by artillery. It proves that the enemy with the support of artillery can successfully escape from their pursuers."

The question arises, why did the artillery withdraw from the heights to concealed positions? Because batteries without shields in visible positions were immedately put out of action. Why did the artillery change position principally at night, just as the infantry advanced? Why during the whole course of the war do we find so many night attacks? The answer is that batteries advancing in open country would have been quickly rendered incapable of moving. Even the infantry in thin lines of skirmishers, in spite of the different method of advancing, moved forward with difficulty in the face of artillery fire. Why the extensive use of entrenching tools and cover of all sort? Because the infantry and artillery had to protect themselves against the increased effectiveness of arms, especially that of cannon. The frequent long range firing was another reason. The effect of artillery fire has been to cause the careful use of natural cover, frequent night engagements, and changed forms of infantry attack. The effectiveness was decreased in many cases by misfire, insufficient data, ignorant use of artillery, poor ordnance matériel; among the Russians numerous examples of premature explosions, bursting of barrels, poor shrapnel and shell were also observed. New rules of tactics and technique were required in the course of the campaign, but this is part of the work of peace.

If certain instances are studied, one gets another impression. One discovers in these that the effect of the artillery throughout the war was insufficient. Yet the reasons for slight effectiveness do not lie in the effect of the projectile, but in defect of equipment and in the wretched use of the ammunition.

The Russian field artillery used only shrapnel, while the Japanese used explosive shell in addition. In the literature of the war we find numerous examples of the effectiveness of shrapnel against unprotected living targets. Besides firing upon the battery crossing the Shaho, heretofore mentioned, Hamilton reports the following facts concerning firing on marching columns: "And the six Japanese guns made good use of the opportunity when they opened fire at 3,000 paces and killed 300 Russians in a few minutes." Von Teil also mentions the remark of a Russian officer that in the attack on Sandepu, Japanese shrapnel had torn "whole corridors"

in the advancing columns. As useful as shrapnel is against unprotected targets, it is of little value against fortifications or troops under cover. The result of shrapnel here was merely to drive the troops behind cover and keep them there. It did not harm them. Examples of this are found in abundance. Von Teil writes of the battle of the Shaho: "The Japanese had entrenched themselves in the farm houses whose walls shrapnel could not penetrate." Further, on page 349 he writes of Mukden: "At daybreak they were fired on by artillery, but entirely without results, for the shrapnel on exploding did not penetrate the loam walls." The General Staff officer of the 17th Army Corps writes to the Artilleristische Monatshefte (1908, page 178): "The field artillery must now realize that shrapnel is entirely ineffectve against weak walls and earthworks, and that it can be used only against living targets." This opinion contains still another criticism. Shrapnel was used against targets for which it was not intended. Thus the failure lay not in the shrapnel, but in the mistaken ammunition supply, and in the false tactical principles, namely, that the enemy would make little or no use of cover. But in this war cover of all sorts was used for protection against shrapnel fire. The result of the slight penetration of shrapnel was that the Russians returned to the old field piece which was supplied with explosive shell. For example, numerous old field guns were emplaced at the Shaho. This was only a slight compensation, however, for the old guns were supplied only with black powder shell. The Japanese, too, changed the relation of shrapnel and shell which were evenly used at the end of the war, but this may have been due to the short range of the shrapnel which demanded the use of shell for long range work.

While it is not to be supposed that in the next European war hostile armies will lie against each other without seeking a decisive battle, we can be sure that cover of all sort will be used more extensively than heretofore. It is almost impossible with the giant armies of the future and their extensive fronts, that buildings of all sorts, and even villages will not intervene, especially in the thickly populated sections of Europe. Even if very little time is available for fortifying, all sorts of material will usually be on hand and easily procurable. The doctrine of tactics that it is often more advantageous to place the infantry positions in front of the village, instead of retiring into them, will be of value as long as we have the

means of keeping the enemy out of these places. If we lack the means, the enemy will make an extensive use of these places as fortifications, as the Japanese did in Manchuria.

The question of open artillery position is similar. If means are available of destroying shielded batteries, the enemy will be more careful about using such positions, than if the destruction of the batteries was only a matter of time. In both cases there would be the one result. We should therefore employ all means of preventing him from occupying favorable positions and drive him to positions from which his effective fire will be decreased. The forms of attack are dependent, not alone on the available material of war, but equally on what is lacking.

The targets not suitable for the fire of shrapnel will in the future be increased by something new, by batteries with shields. Direct fire shrapnel will be absolutely useless except in few favorable cases, and high angle shrapnel fire of howitzers will not always prove very effective, as this method of firing is too complicated for a campaign. This is more the case when we bear in mind that modern rapid fire batteries possess great power, in spite of personnel decreased by casualties. If batteries with shields are to be successfully attacked, they must be attacked with high explosive shell. This promises all the more success if in the future open artillery positions are often the rule. Effective firing against matériel is today more promising than formerly on account of the complicated equipment.

It has been mentioned that very irregular action of shrapnel fuses was observed on both sides, especially with the Russians. This may have been principally due on the Russian's side to hasty preparations, but poor material also contributed to this condition of affairs. It is said the projectile was jolted in the bore and in addition, the fuses themselves were defective. This must accordingly be replaced by a mechanical time fuse which is affected neither by the barometric pressure nor prolonged exposure.

On the other hand, the effect of explosive shell against living targets was extremely slight. It is reported of the battle of Lagoulin (Von Teil 1, page 219): "Although they had fired well, and struck unceasingly with shell, between the guns and the ammunition wagons, the effect was entirely valueless. Of the two batteries which had been under fire for twelve hours, the first lost two dead

and seven wounded, and the second, which was better concealed, only two wounded. I can affirm that in the entire war shell fire against living targets was absolutely ineffective. At times the batteries were enclosed by the black smoke of the exploding shell so that they could not be seen, and one had to believe they were entirely out of action. But when the smoke cleared away, one saw they had suffered no damage at all."

The Russians soon became accustomed to the moral effect so that they had no special respect for the "Shimose," although these shell did immense damage against buildings. The statement is made (Von Teil, 2, page 158) that: "A shell struck the leading horses of an ammunition wagon right before our eyes. Both horses and the rider were literally torn to pieces." Similarly Ullrich states (page 55-56): "The function of Shimose shell is not firing on living targets, but is to be used in attacking light cover such as house walls, garden walls and the light breastworks of infantry trenches. Against these targets shell has been of value and also against the easily destroyed Chinese loam walls, as I could observe in the attack on the village of Dajanaldun on March 5th. Indeed, it appears to me necessary to use a larger projectile than that of the field artillery for the more rapid destruction of hostile cover." Similar conditions prevail for shell as for shrapnel. The effect of shell aginst targets capable of resistance was good. Its frequent use against living targets for which it was not made was an error. This is more or less true of all shell. But since unprotected living targets are the principal targets of field guns, shrapnel must remain their chief ammunition. As troops can quickly get behind cover, artillery must accordingly be in a position to use shell, and for a long time, too. So many difficulties arise from being equipped with two kinds of ammunition that there is the greatest significance for the future in striving for a single projectile containing the properties of both shrapnel and shell.

Consumption of Ammunition.

Another experience which should be mentioned here is the surprisingly great and varying consumption of ammunition in the same battle by different batteries. Certain Russian batteries in the battle of Liao-yang fired 3,304 and 2,600 shots—that is, 413 and 325 shots for each gun. One Russian battery, according to Reichenau,

fired 4,178 shots in the battle of Taschitachao, more than 522 for each gun. There is little data concerning the Japanese, but their maximum number appears to be less. According to the "Artilleristische Monatshefte," 1907 (page 12), single batteries at the Shaho are said to have fired 200 shots per gun in a day. In the "Vierteljohshefte fur Truppenfuhring und Heereskunde" (1908, page 95), the consumption of ammunition at Kintschen by the 1st Japanese Field Artillery Brigade is given as 18,065 shots, about 250 shots per gun. According to the "Militar-Wochenblatt," 1908 (page 2013), 280 shots were fired for each gun at the Yalu, and according to "Streffleurs" (1907, page 636), 800 shots were fired from two guns at the Shaho in one day, that is, 400 shots per gun.

We find in the same battle that the consumption of ammunition by different batteries varies widely. Thus we find at Liao-yang two batteries firing over 2,600 shots, two about 600, four from 100 to 300, and one only 50 shots.

Even if these numbers are changed somewhat by later investigation, there still remains an unusually great consumption of ammunition which on the Russian side is to be attributed to various causes. First of all, the Russians did not possess sufficient familiarity with a rapid fire gun, which naturally permitted great rapidity of fire. With the Russians the entire battery seldom entered the fire at the same time, and this had the effect of apparently increasing the ammunition supply of such batteries. The constant retreat of the Russians may have led them to fire away the ammunition which they could not carry back with them rather than let it fall into the hands of the Japanese. Moreover, the ineffectiveness of firing against concealed targets influenced the Russians to counterbalance the slight effect of a single projectile by a great number of shots. Finally the defective ammunition of the Russians, as already mentioned, was not without its influence on its consumption. For example, Ullrich reports (page 59): "I noticed frequent failures of the Russian Melinite shell to explode—at one place four out of seventeen shots." Some of these causes apply equally to the Japanese, although, because of their better fire discipline, they were more careful with their ammunition.

This lavish expenditure of ammunition caused the Russians to issue orders limiting its consumption, and in true Russian style the

orders were made so binding, that the later limitation of ammunition did more harm than the previous waste, inasmuch as the surplus ammunition often fell into the hands of the enemy. Ullrich relates a drastic instance of this: "At 4:17 o'clock the battery had fired the number of shots which had been allowed for the afternoon and accordingly ceased firing. If the initiative of the battery commander had not been taken away by this order, I was assured by the lieutenant colonel that they would not have ceased firing until they had destroyed the target. The conditions for continuing the battle were the most favorable conceivable. Ammunition was plentiful, the hostile artillery was silenced, the battery was firing well." Further on he says: "The ammunition which had been so carefully spared on February 27 and stored in the battery emplacement, was lost, but was previously rendered useless by removing the fuses."

Even if the Russian consumption of ammunition, as a result of these various local reasons, can not be considered normal, we must count on an increased expenditure of ammunition over the amount formerly used, especially when we consider that neither the Russian nor the Japanese guns were rapid fire guns in the modern sense. The present ammunition supply for the field artillery must be ample, then, with special regard to the experiences of this war.

The varying amount of ammunition consumed by single batteries varies as much as the participation of the artillery in battle. It will be advantageous not to place the batteries in position too early or in very different positions. It will always be possible to select the important positions beforehand, and a change of position may become necessary.

The preparation of a sufficient supply is not the only necessity to compensate for the increased need of ammunition, but means of keeping the firing line supplied are essential. In the first place, there must be a good supply of ammuniton for batteries firing, so that hostile shrapnel fire, disturbing the further supply, can not keep a battery out of action. As a result of the varying amounts of ammunition expended by single batteries, it is essential to keep the column supplied in order that those batteries consuming the most may have their supply quickly replenished. The second essential, especially in open country, is to have a sufficient number

of men for carrying the ammunition, since they are better adapted to the terrain than the ammunition wagons. The Japanese detailed special companies for this purpose, in order not to withdraw any troops from the firing line. Motor cars can be of great use in carrying ammunition to those batteries firing rapidly. A great consumption must be combatted by thorough drill and training of battery and higher commanders so that they will not call for duties inconsistent with the ammunition on hand. This familiarity of higher commanders with the powers and limitations of artillery against different targets is all the more essential since the safety and timely replenishing of the ammunition rests with them.

Organization of the Field Artillery.

If the demand for more ammunition to the firing batteries is accorded, the other demand, namely, that the batteries shall not be too unwieldy, must not be left without consideration. In order to avoid this evil, one can fall back on the often suggested solution, i. e., batteries of four guns. From a purely artillery point of view this can be regarded as the best solution, but of course such a complete change would involve other views of administration, such as available funds and consideration of promotion. Yet this consideration could be met in time by the completion of the change.

By the withdrawal of two guns and the retention of the same number of ammunition wagons in the battery, each gun would gain a third more ammunition, and the batteries would be more easily handled. The four-gun battery can better adapt itself to the terrain, a great advantage in many situations, such as in concealed positions, and when accompanying the infantry attack. The somewhat larger front which is made by the 144 guns of the German Corps in thirty-six batteries of four guns instead of twenty-four of six guns is negligible when we consider the extensive battle fronts which we can expect. It has often been shown that the value of the fire of a rapid fire battery of four guns is absolutely ample, in fact can be better used than the fire of the six gun battery. Even if one gun of such a battery is put *hors de combat,* the fire of three guns is still sufficient. The French have already proposed batteries of three guns. The Russians in the campaign often used a half battery, when their batteries were eight guns strong. This concession

of separating into half batteries of four guns was the best thing for the antiquated Russian artillery organization which lacked regimental formation.

A reduction of the absolute number of guns for the corps by forming batteries of four guns would not meet approval. On the one hand, the offensive power of the army would suffer by it; on the other hand, the separation of certain batteries for special purposes would be made difficult if not impossible. With the greater battle fronts of the future, a commander must be in a better position to be able to place artillery at all points. The disadvantage of the greater length of the marching column by three kilometers could be offset by a broader marching formation for the infantry and the use of automobiles for transport.

It has already been shown that in this campaign shrapnel was of little value against targets offering resistance and under cover. If, contrary to expectation, trials with a unit projectile are unsatisfactory, an abundant supply of shell must be taken in future campaigns, and the shot question will be solved by supplying the gun batteries with shrapnel only, and the field howitzers principally with shell.

According to "Streffleur" (1909, page 118), the Japanese first used at the Yalu one regiment of three divisions armed with the 12 c.m. howitzers, and later added a second regiment. This regiment took part in the battle of Mukden, while the later formed 3rd and 4th regiments were never used. This constant increase during the campaign is the best proof of the value the Japanese placed on high angle fire, and of the good service it had rendered them at the Yalu. General Hamilton states, concerning the influence of howitzers in this battle, that: "These little cannon finally did it." The Russians also recognized their effectiveness. In supplement 70 to the "Revue" (page 17) General Kuropatkin's report is quoted as follows: "The powerful effect of the Japanese field howitzer is noteworthy."

The Russian field artillery used a six-inch field mortar as their high-angle-fire piece. This mortar besides being entirely antiquated and constructed on false principles, had in addition to an ineffective projectile and no accuracy at all, a very short range. This is variously given, but averages about 3,000 meters. The mortar battery accordingly had difficulty in finding suitable positions, and

the battle, drifting back and forth, often brought them to disaster. The field mortar, of which there were sixty in five divisions and ten batteries in the theater of operations, was a failure, as was to be expxected, and during the campaign was replaced in part by 12 c.m. Krupp howitzers. It was never used. Immediately after the war both countries further increased the high angle fire artillery.

The necessity of introducing high angle fire into the field artillery was brought about by the extensive use of field fortifications and cover of all sorts. In firing on targets on the same level guns failed utterly. In the opinion that, in the future we have to deal with like conditions, the much-discussed howitzer question has been decided by us in the affirmative. We see high angle fire introduced in the field artillery everywhere, partly as a result of the introduction of batteries with shields. The howitzer projectile should accomplish the destruction of these guns, however, since their caliber can always be larger than the gun of the same weight. The increase of shell is accordingly more reasonable for the howitzer than for the gun.

The lack of high angle fire at Kintso-hou proves that the field army must possess such fire, whether light or heavy. The shell, as well as the shrapnel of the field guns, although here, the Japanese had 216 field guns against 24 field and 55 heavy guns of the Russians, was absolutely insufficient. At Nanshan one attack after the other failed in spite of this great numerical superiority of Japanese field artillery and in spite of the enormous expenditure of ammunition, until at length the heavy guns of the Japanese gun boats brought success by enfilading the trenches. The Japanese felt the lack of howitzers tremendously at this place. In the "Vierteljahshefte" (1908, page 97) there is the following statement: "It is a fact and the most important lesson we can derive from this battle, is that the Japanese guns were not in a position to harm the Russian trenches or to facilitate the attack of their own infantry in the least, although the Rusian artillery fire from 7 o'clock on became weaker, and from 11 o'clock was everywhere silenced after having been silenced at various points two hours previously." Further on, page 100: "The battle at Nanshan teaches convincingly the powerlessness of field guns against fortified positions. It shows us with what confidence entrenched infantry can await the attack even of greatly superior forces. It shows that

without special means, such as high angle fire and heavy guns, the most energetic and enduring troops will not succeed in taking a fortified and energetically defended position by frontal attack."

If the single caliber of field artillery has been broken into once more by the introduction of the light field howitzer, this disadvantage can be met, as already mentioned, by equipping gun batteries as well as the light field howitzers with only one kind of projectile, shell, shrapnel or a suitable unit projectile. Howitzers are so numerous, however, that as a rule even the smallest division of all arms will possess high-angle-fire pieces.

It would be possible in the already mentioned change of batteries to four guns, to gather howitzers together in howitzer regiments (a measure which would be very desirable for training and for ammunition supply) without removing the relative proportion of guns and howitzers to the disadvantage of the former. The brigade of 72 pieces would be divided into two gun and one howitzer regiments, each regiment into two battalions, one for every three batteries, and the relation of two to one, which is perhaps the best, would prevail.

The field howitzer, if it is to form a part of the field artillery, must possess the same mobility as the gun, and consequently the greatest limit of the caliber cannot be more than 12 cm. The lighter the weight of the piece the more it resembles the field gun in construction, and they can form a higher percentage of the field artillery, and in a great measure can solve the problems of field guns. The Japanese 12 cm. howitzer found difficulty in following the troops on account of the difficult terrain and poor training. According to Japanese views lighter howitzers which could have better followed the infantry in all places, should have been on hand in great numbers. Howitzers fired principally shrapnel, but shell attained the greater moral as well as material effect.

On the other hand, it must be noted that the smaller the caliber of the light howitzer the more it becomes essential to introduce a second and heavier high-angle-fire piece. In the many kinds of problems for high-angle-fire there will be some which the 12 cm. caliber can solve, either not at all or in an unsatisfactory manner. This struggle between mobility and power has today been decided almost everywhere by the introduction of two calibers for high angle fire.

Heavy Artillery.

Since this heavy high-angle-fire piece is not intended to perform all the functions of field artillery, its mobility need not be so great as required of the other pieces. Effect must be considered here first of all, hence the question of caliber, especially if the field artillery is already equipped with a high-angle-fire piece. The chief consideration in this case is to choose a caliber large enough to fulfill all the requirements of a campaign for high angle fire. The supposition is, of course, that it can follow the troops over all sorts of terrain, slower in case of necessity, so that it is essential to take into conideration the probable theater of operations in which this weapon will be used. A lighter piece which is on hand when it is needed is better for mountain country than a heavier one that cannot be emplaced at all, or else too late. This certain and timely emplacing of the heavy howitzer can be secured by other means, such as systematic breeding of a specially heavy draught horse. The fewer the demands that are made for a fast pace for heavy artillery, the further ahead it must march, should it be desired to put it into action at the same time as the field artillery.

There will not always be duties for heavy artillery with every body of troops, but there will be many such occasions in every battle. Accordingly, it can usually be a part of a corps, and only in case of need will it temporarily form part of a smaller unit. Part of it must always be at the disposal of the highest commander, so he can concentrate its fire where he plans to make the assault. The heavy artillery, if correctly placed and supplemented by guns and howitzers of the field artillery, can spare the attacking infantry great loss of blood.

The ammunition for heavy artillery on account of the small supply that can be obtained, will be limited to one kind of projectile—shell. Their targets will be visible but immovable, such as fortified places, redoubts, rifle pits and infantry positions with strong cover, for which the extremely destructive effect of these shells would make them particularly valuable. But above all, heavy, high-angle-fire is of enormous value against visible and recognized batteries of hostile artillery. Against the former, which cannot fire from concealed positions for lack of room or on account of tactical reasons, heavy, high-angle-fire is annihilating. Searching fire against concealed batteries gives good results if the limits can be confined,

by means of observation from balloons or points in the terrain, to a few hundred meters. Searching fire in wider limits would either lack sufficient effect or the result attained would not compensate for the attendant waste of ammunition. It will, therefore, be well to limit its use to exceptional cases. Since the equipment of heavy artillery with shell and shrapnel is scarcely to be recommended on account of the limits of weight that must be adhered to, and since the future wars are bound to see protected targets in abundance, the successful introduction of a unit projectile would significantly extend the value of the heavy howitzer. We must here demand stricter conditions, so that the unit projectile will not be less efficient than the shrapnel or shell, especially the latter.

The lesser mobility of heavy artillery can often be compensated for by its great range. In order that high angle fire can have the advantage without making the pieces too unwieldy for a campaign, howitzers only, and not mortars, should be considered. Heavy artillery is particularly adapted for great ranges as a result of this qualification. If the impressions of the East Asiatic War should be regarded as lasting, the introduction of a heavy direct fire gun with long range shrapnel would be considered. This would, of course, be worth more to countries acting normally on the defensive. In any event, the artillery supplied with the longer range shrapnel has many advantages, as the war has clearly taught. The enemy is forced to show himself sooner and keep further away. The effectiveness of the enemy's shrapnel is reduced, and he is eventually forced to have recourse to shell. The cross-fire intended for batteries with shields is frequently possible only with long range shrapnel. This, then, permits direct fire against such oblique and consequently farther distant batteries. The shorter range of the Japanese shrapnel as compared to the Russian was a disadvantage to the former, as already shown. The Japanese sought to correct this evil by means of a new powder, in spite of the changes in material connected with such a change as braking apparatus, fire-control instruments and fuzes (Supplement 70 of the "Revue"). A second direct fire gun renders the construction of a field piece more independent of many other considerations. The choice of a smaller caliber for the present-day battery with shields, which would permit carrying a larger supply of ammunition, is thereby facilitated and made possible.

By no means, however, do all these advantages outweigh the

disadvantages of burdening the field artillery with a third caliber, particularly, since with respect to the required mobility the difference in caliber and in its accomplishments cannot be very great. This is especially the case if the heavy direct-fire gun be considered as a companion to the high-angle-fire piece in the heavy artillery.

England, as a result of the experiences of the Boer War, had already introduced a heavy direct fire gun into the field army. Japan has followed this example as a result of their own experiences, and now Russia follows suit, the two countries for whom the Manchurian experiences were closest, a circumstance demanding attention. Japan and Russia have chosen a caliber of about 10.5 cm., while England, in replacing its older material by the new 60-pounder, has decided on 12.8 cm. Even if, according to the "Vierteljahrshefte" (1908, page 116), the English piece is comparatively mobile in spite of its great weight, the caliber nevertheless seems very large. The indicated range of over 10 kilometers, which is, to be sure, needed, can be obtained by a smaller caliber.

Protective shields are just as essential for heavy artillery, direct as well as high angle fire, as for field guns. Even if, from their very nature, they will seldom fire from open positions, the hostile artillery will risk everything to silence these most dangerous opponents. The present technical position of artillery can fulfill these demands without adding too much weight to these heavy artillery batteries.

The propriety and necessity of allotting heavy artillery to the field army has been much disputed. The question is still partly in dispute. The next campaign will speak the last deciding word concerning the necessity for the belligerents. The requisite mobility of heavy artillery for a campaign has often been denied. It has been forgotten that heavy artillery is no entirely new appearance in a campaign, as the history of wars teaches us. I mention the Quartermaster, Major General Freiherr V. Freytag-Loringhoven, as a competent and unprejudiced judge in this respect. He writes in the "Vierteljahrshefte" (1908, page 32) concerning the discussed mobility of heavy artillery: "It was not remembered that Frederick the Great in the later years of the Seven Years' War always had heavy artillery with him, because the excellent artillery of position of the Austrians compelled him to do so, and as a rule, ten heavy twelve-pounders were employed with each infantry brigade, guns which were far less mobile and worse teamed than

the present heavy artillery of the field army. At Leuthen such heavy batteries were even improvised of Slogau fortress guns drawn by farm horses. They were not brought to their position in time, but they changed their position after the attack commenced. The reply should not be made that such use could be made only in the ineffective and short range hostile fire of those times. The proximity of the hostile forces at that time caused the fire to be very perceptibly effective. Tempelhoff reports two Prussian heavy batteries which went into position for the first time at Torgau, completely covered by hostile fire, and officers, cannoneers, men and horses struck down in the shortest time." Frederick the Great was forced by the tactics of the Austrians and the great losses in infantry to use this heavy artillery. These "grumblers" marched with the advance guard at Leuthen, Rossback, Zorndorf and Liegnitz, in spite of the fact that they were ten hundredweight heavier than the present-day 15 cm. howitzer. In the instructions to the artillery Colonels Dieskau and Moller of June 30, 1789, the presence of these guns is "always desired in front of the army." In the same paper mention is made of the forced marches, for example, the one to Leuthen and Zorndorf. When we consider the lighter weight, the greater ease of transportation, better teaming, and the present far better and more extensive system of roads, we find no basis in experience for the fear that heavy artillery will not be equal to the demands of a campaign, or that the conduct of the war will be retarded by its use.

On the other hand the increased burden of the army, due to the lengthening of the marching and ammunition columns caused by the addition of heavy artillery, is unquestionable. As long as this extension is not too great, it is amply outbalanced by the great effectiveness anticipated.

The opinion of Colonel Balck, as expressed in his "Tactical Studies," will serve to show the present valuation placed on heavy artillery. It is stated there: "The use of heavy artillery is new, and is by no means an impediment to a command, but one of its most important trumps. * * * It will often be the case that heavy artillery will first make it possible for the field artillery to advance. * * * No commander will give up the co-operation of his heavy artillery without good cause unless it makes possible the freedom of the field artillery to complete a battle. Its most important target is the hostile artillery, which will often come out

into the open in order to have the greatest effect against moving infantry targets. The preliminary condition is observation. Artillery and other commanders must co-operate to prevent favorable observing positions being occupied by a fraction of the field artillery." This opinion is all the more noteworthy, as in the last sentence a very important and heretofore neglected question is touched on; a sore point of artillery fire control. In other words, the effectiveness of heavy artillery depends in the first place on good observation. The heavy artillery should be able to reach all parts of the battlefield of a corps, and so it should preferably be placed in rear of the middle. But the points from which the entire field of battle or at least the greatest part of it can be seen are few and consequently most eagerly sought for. The entire higher staff, corps, division and brigade commanders, will all want to see everything, even today, when commanders have to conduct the battle from maps. Then there are two field artillery brigades with four regiments, eight battalions and twenty-four batteries, and they will clamor to see everything, more or less. No matter how far the highest commander may give up his direct influence on the heavy artillery in favor of the artillery commanders, his personal care that the available observing positions be given to his heavy artillery will be richly rewarded in every case. It is better that a staff does not see everything and that a battalion of field artillery is not used to its greatest advantage. The corps has over eight battalions of field artillery, but only one battalion of heavy artillery. Let the commander take care, accordingly, in the words of the above opinion, so that he can play one of "his most important trumps."

Heavy Artillery in the War of 1904-1905.

Neither of the belligerents had any heavy artillery that had been organized in time of peace. As a result of this deficiency they used numerous and in many cases antiquated fortress and siege pieces, the Japanese using even a 28 cm. howitzer. The possibility of substituting siege guns for heavy artillery was provided only by the month long lull in operations, an experience which would not occur under normal conditions. Lighter calibers will usually be used since there is little time for strengthening projects of defense. As a rule the caliber can accordingly be limited to 15 cm. The few

cases in a campaign where this caliber will not be more than ample, where we must fall back on heavier cannon, do not belong any longer in the jurisdiction of the pure campaign, and accordingly need not be considered.

On the other hand the frequent transportation of these pieces from battle to battle, in the face of the insufficient and arduous condition of the roads and transportation facilities, shows what importance both army leaders attached to them. Only the most pressing reasons could have allowed this extraordinary expenditure of time and energy. Whether this variegated pattern-card of old cannon with their various projectiles and all sorts of fuzes and explosive charges possible justified in their material and moral effect the time and labor expended on them has often been debated in German literature. Whether or not an effect is fully realized depends on greatly varying tactical and technical conditions. At any rate the possibility of this effect was present. Bronsart V. Schellendorf in "Six Months with the Japanese Army," writes of the battle of Mukden: "It (the Novgorod Hill) appeared like an observing position and also appears to have served as an enclosed infantry work for about one company. But as it had been the target of the 28 cm. howitzer for over eight days, it was unrecognizable. * * * The Putilow Hill showed similar traces of the terrific destruction as the Novgorod Hill. The fortification was absolutely untenable and had actually been evacuated several days before." Even more favorable is the opinion of the war correspondent of the "Kolnische Zeitung," First Lieutenant Ullrich, a former Prussian infantry officer, in his already oft-quoted and cleverly written field diary. He had the opportunity with his personal relations to the commander of the 3d Infantry Division, General Orlof, of thoroughly knowing Russian conditions, and his notes are recommended by Colonel Balck as particularly valuable. He reports in his diary the following concerning the effect of the heavy artillery (page 117-118): "The heavy artillery of the army has become, far more than the field artillery, an important weapon for the preparation of the infantry attack. It was this which broke up the positions of Hantschenpu in the battle of the 35th Division on the 6th and 7th of March. * * * The result of the firing by the heavy artillery was splendid, the positions were untenable, and the division commander, and he only, perceived this. The infantry

boldly and tenaciously remained in the ruins of the places, but the battle was decided on the evening of March 6, when under the concentrated fire of the heavy artillery, the Russian strongholds, 'railroad redoubt' and 'Hantschenpu village,' were reduced to a heap of ruins." Similarly, on page 123: "Heavy artillery was the most destructive of material and far surpassed the accomplishments of the field artillery, even if the varying character of the targets for the two types is taken into consideration." Again on page 256: "Heavy artillery has proved itself to be a much more important weapon of attack (than the field artillery). The Russian heavy artillery accomplished but little, simply because they did not know how to use it. The Japanese heavy artillery did such complete damage to the redoubt at Liuschinpu on March 6 with six perfect hits from their 28 cm. pieces, that it was the reason for the 3d Division retiring. On March 6th and 7th the wire obstructions and breastworks of the railroad redoubts and the interior works of Hantschenpu were swept away by the enemy's heavy artillery fire. In one place the breastwork had fallen into the ditch for a space of more than 20 meters, so that both were leveled. The attack of March 7th and the subsequent victory of the Japanese at evening were decided by the fire of the heavy artillery." Japan's introduction of three new pieces, 10.5 cm. gun and 12 and 15 cm. howitzers, shows the value they place in heavy artillery. Japan would not otherwise have increased so extensively its heavy matériel in the organization of its artillery after the war, and added the difficulties connected with training and ammunition supply of three different calibers.

There are various reasons why the effect of the numerous Russian pieces did not compare with the Japanese. As already mentioned, the anxious leaders held their pieces back from fear of losing them, or else withdrew them from their positions too soon so that a great part was never used at all. Even those which did fire were prevented from having greater effectiveness on account of the poor matériel of the Russians. Shell was lacking for most if not all their pieces.

The effect of weapons is also to be looked for in losses. We find in Supplement 70 of the "Revue" (page 23-24) an opinion of the staff physician, Dr. Schafer, that "most of the deaths on the Russian side could be attributed to the effect of heavy artillery."

Dr. Schafer was present in the theater of war from the beginning of December, 1904, commissioned by the war ministry to study the sanitary measures of the Russians.

Losses by Artillery Fire.

In connection with the above-mentioned opinion, I might touch upon the effect of artillery fire in this respect. The very low percentages of those wounded by artillery fire in the beginning of the war were adduced as proof of the slight effect of such fire. Investigations have shown, on the contrary, that this pro rata share has grown as compared with previous wars, especially that of 1870-71. In a paper in the "Archiv für Klinische Chirurgie" (1906, page 951) the number of killed by gun fire is given by Dr. Schafer together with two Russian physicians who were in the war as: Prussians, 1866, 16 per cent; Austria, 1866, 3 per cent; German, 1870, 8 per cent; Japanese, 1904-05, 7.6 per cent. The same authors say in the second part of this paper, concerning the effect of Japanese weapons: "Accordingly, the frequency of wounds by artillery has increased significantly, and is 22 per cent for the whole war and all troops. The number is correct; at all events it is rather too low than too high, etc." Elsewhere in the 1906 volume (page 951-52) it is stated: "At all events the percentage of wounds from artillery was much greater than on the German side in 1870, and that in this war the artillery played a much smaller role, there can be no doubt." Occasionally even 22 per cent was surpassed, for we find in the same paper (page 930) 32 per cent of the killed among the officers of three army corps for the entire campaign was due to artillery fire, and 35 1-2 per cent of fatal wounds and those ending in death. These statistics are not sufficiently detailed. Even if we do not demand directly fatal wounds from our weapons it does not suffice to keep the man out of a single battle, but to accomplish the purpose of the war we desire that the man should be useless for the remainder of the campaign. Statistics of fatal as well as bad wounds caused by artillery fire would show themselves much more favorably since artillery fire, as is pointed out in the "Vierteljahshefte" (1908, page 169) from a medical point of view, especially caused many fatal wounds. This view is confirmed by the above-mentioned paper. It is stated there in the 1907 volume (page 986): "Statistics confirm the fact that artillery wounds

with few exceptions caused a man's absence from his regiment a longer time." The same author states especially concerning the effect of heavy artillery at the Yalu (1907), page 940: "Japanese howitzers especially by indirect fire developed a far greater power and more extensive effect. We soon saw the frightful effect of the fire in the dead and wounded." A somewhat smaller percentage is found on the Japanese side. Hamilton quotes a Japanese surgeon as follows (page 344): "That to every hundred wounds from rifle bullet, there were twenty from artillery projectile and two from bayonets," thus about 16 per cent, and in the Militär-Wockenblatt, No. 102, 1911, page 2,350, the Japanese war ministry gives the number as 15.35 per cent.

Mountain Artillery.

The necessity for mountain artillery to replace or supplement the field artillery in mountainous terrain has already been mentioned. On account of their limited power, however, they will always remain only a help in time of need for mountain warfare. Consequently, after the war the Japanese very significantly reduced the number of battalions of mountain artillery to three or four of three batteries with six guns each.

Horse Artillery.

Horse artillery has shown itself to be still another type of field artillery that is essential. Baron V. Tettau, who surely does not exaggerate Russian conditions, writes concerning the retreat after the battle of Liaoyang (1, page 361): "If a single hostile cavalry division with a battalion of horse artillery had crossed the path of retreat of the Russian army, they would have gained a decisive result for the entire war." And that in the moderately orderly retreat from Liaoyang. The same author expressed his opinion as follows of the retreat after the battle of Mukden: "How the Russian retreat after the battle of Mukden would have fared, if a Japanese cavalry corps with horse artillery had appeared in the path of the retreat, is difficult to imagine." According to his own words panic reigned at various times and places. Ullrich draws a gloomier picture when he states: "The wildest disorder prevailed in the retreat of this (17th) corps. It was not a retreat, but a flight, as at the Beresina. * * * I saw during a later panic one of the

infantry brigade commanders of the 35th Division in a mad gallop to the north, and many other officers who threw away their sabers, felt boots, and even their coats and fur caps, in order that they could flee faster." After a clear and interesting presentation of his experiences, which one must read in detail in their place, he closes his report with the words: "The ordered retreat looked as it was reported to Petersburg. I can only repeat what an officer said to me at the outbreak of the first panic, 'It cannot have been worse at the Beresina.'" In this case a catastrophe would have been unavoidable.

Cavalry without sufficient fire support of artillery as well as machine guns, is worthless, for it must count on contact with large bodies of troops from the gigantic modern armies, and accordingly must be in a position to offer them a short resistance. A careful teaming is the most favorable possible relation of war and peace conditions. The joining in peace of the horse artillery regiment to a cavalry division, with the idea of peace training that will be useful in war, would be of value. This training and organization must be so extensive and favorable that the batteries will not under any circumstances impede the cavalry, but will enhance their offensive power in every situation. With this greater independence of the horse artillery there can eventually be a light gun supplied with one kind of ammunition.

These remedies, if adopted, would return rich interest. They strengthen not only the offensive power of the cavalry, whether it is used as cavalry on scouting duty, for the battle or for pursuit, but also by increasing the power of pursuit of the whole army, will influence the entire conduct of the war by a quicker ending of the campaign and more favorable terms of peace. If the Russians had not always been able to reassemble, the self-sacrificing love of country and contempt of death of the Japanese soldier would have borne richer fruit. If victory is gained in the first place, the victor must be in a position to reap the fruits of his victory. Napoleon has said: "Victory alone is nothing; one must make use of success." And that is true in respect of strategy as well as tactics.

The Japanese themselves realized their deficiency in horse artillery, and sought to help conditions, according to "Streffleur" (1907, page 643), by providing single batteries with selected teams, and decreasing weight as much as possible. But above all things they were deficient in numerous and well-mounted cavalry. They

have now corrected this mistake by introducing horse batteries with a special gun.

The Russian horse artillery could naturally accomplish little in the constant retreat of the Russian army. When it could have been used, for example, in the raid of General Mischtschenke at Yingkou, leadership was lacking in the Russian cavalry, as was nearly always the case.

This slight spirit of enterprise on the part of the Russian cavalry, as well as the small number of the Japanese, is the reason that there is no example in the East Asiatic war of the necessity for protection of batteries, and consequently we find ammunition columns on the march and in position protected by small arms—either all the men equipped with rifles, or else the column was provided with machine gun companies and batteries.

The possibility of solving all these different problems in the field by means of a single caliber is excluded for the time being, if not for all time. The mere conduct of war must reckon, not alone with man as an enemy, but also with its technical side as a factor in battle. These duties have become varied, and will become even more so in the future. Think of balloons, flying machines, searchlights and the like. With a single caliber a certain percentage, if not all of them, will have to be given up. There are the disadvantages of equipping the artillery with different calibers and the difficulties of replacing personnel and ammunition. The first is unimportant if the varieties of artillery weapons are sufficiently numerous. The other disadvantage, the difficulty of ammunition supply, can be outweighed by supplying all pieces with one kind of ammunition, the unit projectiles.

But it must be remembered that this greater diversity in artillery demands on the part of troop leaders a greater familiarity, not only of the tactical and technical uses of artillery, but also with the duties they can and must demand of the different branches of that arm.

Course of the Artillery Combat.

Another circumstance which prejudiced the effect of artillery was the altered tactical and technical conditions already described. As long as the artillery was a visible target during the first half of the war, its effect could be fully seen. But it was otherwise in the

later part, when the artillery invariably fired from concealed positions and the infantry fired from deep trenches and other shelter. Searching fire against concealed batteries was very unsuccessful, and never brought about the destruction of the artillery; the pieces designed to fire at the concealed infantry repeatedly failed in their mission. It was not alone changed conditions on the side of the enemy which decreased the effectiveness of artillery, but also the firing from concealed positions against concealed artillery as well as against advancing infantry. The excellent result obtained by indirect fire, according to Russian reports, were often represented later by eye witnesses on the Japanese side as much exaggerated. Such, for example, is the activity of two batteries of the artillery brigade at Liaoyang as mentioned by Von Teil.

As a result of this decreased effect of artillery, a new method of firing arose which will frequently be the rule in the future, for like causes produce like effects. Since the attacking artillery as a rule no longer succeeded in gaining fire superiority by overcoming hostile batteries, the infantry attack was inaugurated during the artillery duel. Thus artillery and infantry combats were no longer separated. The infantry attack, however, never remained without the support of the artillery, even at the closest ranges. In the war in Manchuria this continued support by artillery fire was valued so highly that the Japanese infantry themselves asked, without regard to their own peril, that fire of position be continued up to the time the positions were taken or they indicated by flag signals that further support was no longer required. The Japanese howitzers first ceased their firing when the infantry had arrived within about 50 meters of the hostile lines, the guns, of course, having ended their fire much earlier. Concerning the never entirely avoidable losses from their own fire, the following statement is made in the "Artilleristische Monatschefte" (1908, page 107): "According to the views of the Japanese the losses were slight in comparison with the effect, as they could come up to within a few hundred meters and then open fire." Another peculiar novelty of the war was the occasional silence of the batteries, a device which was used by both combatants. In an especially strong fire the personnel would take cover, firing would cease, and would recommence when the enemy had decreased his rate of fire or ceased firing altogether, in order to save ammunition. Hamilton describes a case at the battle near

Yoshirei: "The Russians got their range in an instant, and in a couple of minutes every Japanese gunner, not killed or badly wounded, had cleared fifty yards back under cover of a road cutting, whilst the twenty-four guns until now so aggressively noisy, were left standing by themselves, silenced. As soon as the Russians were satisfied of their victory they too ceased fire. * * * By and by the Japanese gunners came creeping back, and I could clearly see them handling their guns and changing their position so as to baffle the Russian ranging next time they opened." The moral consideration which can be brought against the procedure must be worked against by constant schooling in time of peace.

Let us now try to sketch the co-operation between infantry and artillery as it will occur in the future according to the experiences in Eastern Asia, repeating briefly what has already been said. First, the attack of a prepared position. The artillery of the defense is principally in concealed positions, the infantry in field fortifications or shelters more or less substantially built, depending on the time at their disposal. At the first approach at long range only a relatively small part of the defensive artillery will fire. The attacking artillery will only be prepared at first. In place of the former immediate general placing of the artillery we have the general preparation. The few visible as well as the concealed batteries already firing will come under the fire of a great number of batteries and an attempt will be made to destroy them. Visibly emplaced decoy batteries at great ranges or with wide intervening spaces must try to cause the entire artillery of the defense to fire and reveal its position, in case the enemy does not willingly do so. Even these methods will not always be availing. Then the infantry must draw nearer. The defenders must now follow suit. If his infantry can still remain concealed in their shelters and trenches without occupying the firing line, his artillery must exert every effort to hinder the advance of the hostile infantry. The attacking artillery must now employ all its resources, and as long as both infantry forces are still widely separated must try to destroy the hostile artillery in order to facilitate the advance of the infantry. The more the infantry attack advances, the more batteries of the defense must come into play, until at length, all are firing. Those batteries which have been silent for some time, probably to deceive the attacking force, must reopen fire. Some batteries will advance

from concealed into open positions in order to be in a better position to repel the attack. At all events the approach of the infantry will furnish many new targets for the artillery, and the possibility of destroying them will facilitate the advance of the infantry. The infantry attack not only procures new targets for the artillery, but also new positions, which in turn make other targets visible and are consequently of greater importance in a conflict with concealed artillery. The immediate seizure by the artillery of new observing positions is just as important as a change of position by the batteries, and much easier of accomplishment. Thus infantry and artillery must play into each other's hands. When and how much artillery for the support of the infantry attack against hostile infantry will advance, especially against the point of assault, will depend on the position at all times, on the effectiveness of the attack on the artillery, on the relative strength of the opposing artillery, and on whether or not the attacker has special pieces (high angle fire) for preparing the assault. If we work on the proposition that the artillery will always combat those targets most dangerous to the infantry, it follows that the guns must turn against the hostile infantry as soon as their own infantry passes within effective rifle range. As many batteries as can be spared from the artillery duel will be assigned to this task, and as the infantry approaches the point of assault the number must be relatively increased. It is unconditionally essential that artillery must prepare the hostile position for the infantry assault. The modern infantry rifle, supported by machine guns, possess such great fire power that even the Japanese, whose infantry unmindful of losses, was always glad of a chance to attack, were torn to pieces at very short range from the hostile positions which had not been sufficiently prepared by artillery fire for the charge. An example of this is the already mentioned attack on the Kinschou position. In preparing for the charge against a position the artillery must direct special attention to machine guns, since the defenders, whose artillery is firing from concealed positions, will use many machine guns from flanking positions and to cover dead angles of the artillery. The destruction of machine guns will become all the more important when they are protected with shields and become almost invulnerable to infantry fire.

It is necessary to support the infantry until just before the charge, since a previous cessation of artillery fire may make the attack a

failure. Artillery fire is accordingly to be maintained as long as friendly troops do not prevent it. Supervision of observing positions and the ability of observing the fall of shots is important. Shell is better adapted than shrapnel, as the percussion fuses show better the relation of the fall of the shot to the infantry. Add to this the greater moral effect of such a shot. In this artillery support there is one more valuble effect against the defenders, and that is to lay before the enemy a thick veil of smoke from bursting projectile which will make it difficult for the enemy to find an aiming point and facilitate the advance of our own infantry. Since this support by the artillery is easier, as it approaches nearer the point of attack, single batteries should accompany the infantry attack close up to the hostile position, for the moral as well as the material effect. High angle fire will be doubly useful here.

Our western neighbors put so high a value on the co-operation of the infantry and artillery that they detail batteries whose special mission is to accompany and support the infantry. Even if the name infantry battery is omitted from the new French regulations their duties still remain the same.

The importance of the co-operation so emphatically demanded today not only of the infantry and artillery, but of all arms, justifies at this point a digression from the subject in order to touch upon two question of common significance; that is, in order to act intelligently with other arms one must be completely familiar with their activities and use. For example, if a cavalry or infantry patrol leader is to bring information of real value to the artillery, he must know what information they want, otherwise he will report matters of indifference and neglect the essential. It presupposes rather more thorough knowledge of other arms than one can or will glean from the rules of the service. The often proposed temporary transfer of officers to other arms will be the only solution, and it must be for a time sufficiently long so that the officers can receive practical ideas of actual service. If these transfers are reciprocal and occur only among troops in the same garrison, there will be little expense, and if no officers are passed over, the older officers, after a short time, can be used advantageously everywhere in the service.

The more the present-day battle demands close co-operation between all arms, the more it becomes necessary that a short chapter

concerning the tactics of other arms be included in the regulations of each. In this would be included the principles of attack in meeting engagements, attack on enemy prepared to take the defensive, on field fortifications, the principles of a turning movement, defense, delaying action, pursuit, retreat, cessation of fighting, etc., etc. The principles of leadership and relations to the other arms also belong in this chapter, and in addition, the laws regulating the activity of troop leaders, artillery commanders, and commanders of heavy artillery. If this section is fully treated in all regulations, co-operation will seem easier and be attained more surely. Then the commander of each arm can intelligently carry out instructions of the superior commander and make correct dispositions. Then, for the first time, will the different arms learn to support each other properly. Then many misunderstandings and difficulties, which are to be attributed to lack of instructions in regulations, will disappear. This first section which would be common to all regulations, could be followed by a second part which would contain the necessary technical peculiarities of interest to one arm and not to another.

The length of time it takes to make the attack described depends on the strength of the position, the relative strength of the opposing forces, and also on the absolute size of the forces, so that in modern armies, with the longer time for deploying, advancing and turning movements, the battle can seldom be ended in a day. It will often be continued at night which the attacker will use for enterprises which can not be undertaken by day, including in this for the field artillery, changes of position and replenishing the ammunition supply for batteries and columns.

The activity of the artillery of the defense is obvious from what has been said concerning the attack. The defensive artillery must only keep in mind that its chief target is the attacking infantry, that as the infantry draws nearer, it must engage them more and more until finally they are its only target, and the artillery must not be led into an artillery duel with the artillery of the attack. For it is the infantry finally which takes the position, and as long as they are held away from it, it is still a secure possession. The artillery, especially with its present protective shield, must not hesitate to pass from concealed to open position with the gradual approach of the attacking forces, in order to be able to ward off the infantry attack.

Firm rules can be set up for the meeting engagement since here conditions can be so different. Pure meeting engagements of large forces will be fewer than formerly in this age of improved means of reconnaissance and communications, but the principles of the use of artillery will be the same even under changed conditions. In such a case the attacking force will be favored, especially if the defensive position is not naturally strong and there is little time for the defender to strengthen his position.

The mass of the artillery will no longer enter the battle as early as formerly, but frequently is merely prepared for action, so under the circumstances, there can be an alteration in the order of the march. It should be considered whether the light mobile field artillery should not march in rear of the slower infantry, for example, between two infantry brigades of a division, or, behind the first regiment of the last brigade. Every infantry battalion that marches in front of the field artillery is a half hour nearer the control of the troop leader.

Fire Procedure.

The experiences of the East Asiatic war with reference to fire procedure are comparatively few and extend principally to the new appearances in the Manchurian war. Firing on concealed batteries in the second half of the war seldom or never led to destructive effect. Scattering fire against concealed targets whose positions were unknown was absolutely unsuccessful, if shell was used. It is stated in V. Teil (1, page 304): "The Japanese could not discover the position of the two batteries, and although they scattered shell on both sides of the chasm on the northern side of the hill, they did not hit the batteries. The losses of both batteries were confined to two men wounded and three killed. They were not touched by artillery projectiles, but were hit by rifle bullets which flew over the mountain."

The slight effect in depth of shell increases its ineffectiveness until against living targets it is literally nil. Conditions will be similar in future. Shrapnel can be used as the only pure searching shot, or perhaps a unit projectile with shrapnel as its base, may accomplish good results. Difficulties have been augmented for shrapnel since a new part of the targets, viz.: batteries

with their shields have become practically invulnerable to shrapnel fire, at least from the front.

Firing with shell against concealed targets, which has increased in significance since the introduction of the shield, will have good result only if the effect of the shots can be observed from the flanks or from balloons, or at least the boundaries within which shell must be scattered can be definitely limited. During the war it was frequently necessary to employ auxiliary observers, and usually with good result.

The effect of searching fire against concealed places in which troops were suspected of being harbored, often used by the Japanese in the beginning, apparently did not justify the wasted ammunition, so that later it was used only against communications in fortified places. It should be noted here that the reason for the unsatisfactory effect is to be attributed to the use, for this searching fire, of shell to which the Japanese were compelled to resort at longer ranges.

Better, if not direct material effect, was frequently obtained among mounted troops, columns, etc., by horses running away. Limbers and wagons behind runaway horses were often observed as a result of this scattering fire by the Japanese, and it took a long time to bring them back. The mobility and ammunition supply of the battery would frequently be disturbed for some time.

Hamilton mentions (page 70) maps of the hostile position in squares that were used as an auxiliary means of controlling howitzer fire in the battle of the Yalu, similar to those used in fortress warfare, and with which the batteries and observing stations were supplied.

Good effect against visible targets was not secured with the use of time fuzes. Originally the Russians used these almost exclusively, but later they changed their practice and often employed percussion fuzes. These latter, as a rule, were employed by the Japanese from the beginning. The Japanese used both kinds of projectiles in uniting the fire of many batteries against one target, partly on account of the better opportunity for observation that resulted, and partly the greater moral effect. For the first reason direct and high angle fire were combined.

Salvo firing, which the Russians used with relatively great and rather regular time intervals, did not prove a valuable method. The

following statement appears in "Streffleur" (1907, page 635): "The Japanese artillerymen often used the following described method to escape the effect of the Russian fire. Their observers watched for the flash of the shots in the salvos, signalled the men serving the piece to seek cover and they remained there until the Russian shrapnel had exploded, whereupon they could recommence firing without danger until the next salvo from the Russians." In addition, the fact that salvos of shrapnel give a clue to the number of batteries and consequently the strength of the enemy, as the Austrian Colonel of the General Staff Corps, V. Bacsany, who followed the campaign on the Russian side, mentioned in his book, "Die Schlact" (page 107), does not add anything in favor of such methods.

The sudden fire attack has been adopted in war and will play an important part in the future. The greater the rapidity of fire of guns becomes, the more the artilleryman must economize his ammunition, which can not be increased in the same measure as the rapidity of fire. On the other hand, favorable targets will offer themselves, often only a comparatively short time, since troops seek to conceal themselves as much as possible on account of the destructive artillery fire against visible targets. No matter how sparing the artilleryman may be with his ammunition against poor targets, the rapid fire gun should be used to the greatest extent of its power during the short moments favorable targets are offered. Well trained observers of the terrain and drilled manning details are the conditions by which a sudden fire attack can be successful, and justify the greater expenditure of ammunition. A reliable range finder is of great value in this case only. The necessity of being able to fire successfully upon such momentary targets must be recognized in the principles and rules for firing. The efforts to increase rapidity of fire eventually by automatic guns can be justified by the desire to use the smallest period of time to advantage.

Night Battles.

One result of the increased effectiveness of infantry and artillery weapons against visible targets has been the numerous night engagements of the East-Asiatic war, and with such we shall have to deal much more in the future. The participation of the artillery in them, until a better method of illuminating the battlefield is discovered,

will be limited in the case of attack, at least no new targets will be fired on. It will easily happen that targets fired at by day, should be held down by artillery fired during such attempts at night. A more certain system of communications with the infantry, so that the artillery will know when to cease firing, is even more essential at night than during the day, especially if attacks are directed against targets under fire from the artillery. The result of experience concerning what influence the changed temperature conditions at night have on ranges, has shown it to be slight, bringing about an increase in range.

In the defense, participation by the artillery will be more extensive since the risk of imperiling friendly troops is not so great.

Besides these nocturnal undertakings, changes of position as well as replenishing ammunition supplies must be undertaken by the defense, and more particularly so by the attacking artillery. Frequent exercises of this nature in peace time are needed so that these movements, planned by day and noiselessly executed at night, will not excite the attention of the enemy. The Japanese, schooled by much practice, showed themselves very adroit in these enterprises. Positions and roads for marching were carefully searched out by day and marked, and at night very cleverly found and occupied.

The experiences of the Russian-Japanese war are manifold. It has brought something new in almost every department. Also, much that was old, and considered out of date and was commencing to be forgotten, has been reinstated. The most important of these experiences which this war has recalled, is the undiminished significance of the psychological demands on leaders and troops. Every state is careful that its army is equipped with the best arms. But science strides forward unceasingly and often in leaps and bounds. Tomorrow can see today surpassed, yes, even completely out of date. Indeed, it is important that the sword is sharp and cutting, but the weapon alone accomplishes nothing. The man who bears it gives the blow.

SOME TEACHINGS OF THE WAR IN THE BALKANS ON THE TACTICAL AND TECHNICAL EMPLOYMENT OF ARTILLERY.

Translated from the Revue d'Artillerie, for February, 1913.

BY COLONEL A. H. C. PHILLPOTTS, R. A. (RETIRED).

Reprinted from The Journal of the Royal Artillery.

The following are extracts from notes made by General Herr of the French Artillery, during an unofficial visit to the seat of war in the Balkans, when, with the permission of the Servian and Turkish authorities, he was able to visit, first the Servian lines as far as Uskub and the field of battle of Kumanovo, afterwards Tchataldja as far as Hadankevi.

INTRODUCTION.

There are many questions which can only be settled satisfactorily by the arbitrament of war, and this is the first occasion on which two artilleries armed with the most perfect modern weapons have been opposed to each other.

One—the Turkish—was armed with a German weapon, instructed, directed and in some instances commanded by German officers; the other—the Balkan States—employed a matériel almost identical with that used in the French artillery, and commanded by officers trained in the French School.

The author wished to see for himself, on the spot, what took place actually during the operations and often on the field of battle, or in some cases a few days after.

THE ARTILLERY AT KUMANOVO.

A. ITS EMPLOYMENT.

On the 10th November, the first army marching south encountered the Turkish forces which had assumed the offensive to the north of Kumanovo.

On the morning of the 11th, four Servian divisions were in line, the 5th being in reserve on the left. The left was flanked by the

cavalry division with its horse artillery. The heavy artillery was in rear of the centre.

Up to 11 o'clock, the Servian artillery could do nothing owing to the fog. When this lifted, all the Servian batteries at once opened on the enemy's artillery in order to silence it.

This was for them an easy matter, for the Turkish batteries had come from under cover in order to be able to attack the Servian infantry first of all, and not to concern themselves to answer the fire of the Servian artillery.

Having thus secured their complete freedom of action, the Servian batteries directed all their fire against the Turkish infantry in which they caused such devastation that the attack of the Servian infantry was withstood only with difficulty. The Turks soon beat a retreat and were further devastated by shrapnel fire.

The Morava I. division, while advancing west of the railway in the attempt to turn the Turkish flank, was subjected to the concentrated fire of three Turkish batteries. Two of these firing from open or exposed positions, suffered the loss of nearly all of their personnel. But the third battery, in a well covered position near the "Four Trees" west of the railway, decimated the Servian infantry by oblique fire until it, in turn, was silenced by the concentrated fire of the Servian field and heavy batteries.

B. CONCLUSIONS.

1st. *Artillery is able to destroy its targets*.

(a). *Artillery targets*. It has been assumed that shields would give such complete cover to the gunners that it would be possible to serve the guns under a heavy fire, and that a battery under cover might be neutralized but could not be destroyed.

The battery in action near the trees being put out of action shows that this is not always the case.

(b). *Infantry targets*. Statistics, principally obtained from the hospitals, show once more that wounds from shrapnel bullets take longer to heal than those caused by rifle bullets. The latter, if they do not kill, only disable for a few days, while the former disable for the rest of the campaign.

Further than this, and contrary to what has usually happened up to now, artillery fire seems to have put more men out of action than that of infantry.

2nd. *The artillery duel is a necessity*.

Owing to having refused this, the Turks lost the whole of the personnel of their artillery.

The Servians, owing to having fought the artillery duel with success, were able to fight with two arms of the service against one. By this means they were able to succeed in their attack in the open with only slight losses to their infantry, while the enemy's losses were heavy.

3rd. *Superiority of oblique fire*.

On the Turkish left, one single battery near the "Four Trees" firing obliquely, inflicted such losses on the enemy's infantry that it considerably hindered the advance of the whole division.

The battery itself was wiped out by oblique fire.

On the Servian left, the horse artillery using oblique fire, checks the Turkish infantry's advance.

4th. *Consumption of ammunition*.

The very considerable results obtained by the Servian artillery were achieved with a very small expenditure of ammunition—120 rounds being the average per gun.

N.B. The total consumption of ammunition in the Servian Army was, up to the fight at Monastir—15,000 shrapnel, 2,000 shell, and 5 million rounds of rifle ammunition.

If the Turkish batteries had been under cover, no doubt many more rounds would have been required to silence them. Hence we cannot judge from this battle what would be the consumption of ammunition against artillery hidden from sight.

Nevertheless, in view of the results the consumption of ammunition was small. This the Servians attribute to the following causes:

(a). Examination of the ground before fire was opened.

The range of a great number of objects was found by trial shots beforehand. The enemy was then taken unawares and fleeting targets were successfully fired at.

(b). The employment of observation ladders.

Servian officers are of opinion that a knowledge alone of ranges beforehand would not have enabled them to silence the enemy's batteries and infantry with such a small ammunition consumption, had they not had the use of ladders. Without them, the transmission of orders would have been difficult, and in order to observe, commanders

of batteries would have had to move to the hill crests at a distance from their batteries.

THE ARTILLERY AT MONASTIR.

Employment of the Artillery.

On the 16th November, the Turks were in position in front of Monastir. To the east the heights of Orizani, to the north, the heights on the right bank of the Semnika.

On the east front, their artillery consisted of 75 m.m. field guns and 120 m.m. howitzers.

On the north front, the batteries were in two lines. The front line consisted of 75 m.m. guns, 120 m.m. howitzers and mountain guns. In the second line were only 75 m.m. batteries.

The Servian army marching from Prilep had to attack these positions.

On the 15th the army deployed *under cover of its heavy batteries* posted at Vasarvca and at Ali-Oba.

On the 16th the attack followed the valley of the Karasov and the hills on the west.

The Servian artillery was at this period divided into two sections. On the right (the west) seven long 120 m.m. guns, and four 120 m.m. howitzers at Petilap. On the left (the east) four 120 m.m. guns, five 150 m.m. mortars, near Vaklar. In the centre a grand battery of 75 m.m. guns, the artillery of the Timok division, and some of the guns of the Drina and Morava divisions.

The mountain batteries were used exclusively as batteries to accompany the infantry.

The following are the only particulars we have as to the employment of this artillery:—

1st. The 120 m.m. guns opened fire from Petilap on a battery posted in the front line at Kuretchanie.

The Turkish artillery posted at Kirklina endeavoured by a counter-attack to disengage this battery, but it was outranged.

Three guns of the Kuretchanie battery which were discovered by the flashes of discharge were silenced.

The fourth gun at some distance from the others could not be located and escaped destruction.

2nd. The Danube division while trying to pass the Novak bridge, was taken in flank by two Turkish groups on the eastern front,

and was only disengaged by the fire of the heavy guns at Vaklar at a range of 6 miles, which fired obliquely on the Turkish batteries and partially silenced them.

3rd. After the Servian obtained the mastery over the Turkish artillery, the infantry attacks were able to proceed. They continued on the 17th and ended on the 18th by the rout of the Turks.

4th. The Servians followed the example of the Japanese at Manchuria and used their mountain artillery to follow the infantry, making what use they could of cover.

CONCLUSIONS.

1st. *The Artillery duel is a necessity*.

The Servians always endeavoured to obtain a definite superiority over the Turkish artillery. Only because they were able to obtain this superiority were their frontal attacks successfully carried out over the open country in the marshy valley of Kara Sou against a strongly held position.

2nd. *Advantages of, and necessity for the employment of long range guns*.

The following question was put to the Commander of the Servian artillery:—

"Is it the necessity for a flat trajectory which made you have recourse to heavy artillery"?

Answer: "No. We merely wanted the long range of the guns, and the large capacity of the projectiles."

Thus the employment of long range guns permitted the destruction of the enemy's artillery at Kuretchanie.

And the 120 m.m. guns helped materially the advance of the Danube division when assailed by two batteries, against which the Servian light field guns were powerless.

3rd. The employment of mountain artillery in this battle.

The Servians as well as the Turks employed a considerable number of mountain guns. They were very useful in the hilly country. At Prilip, on account of the ground, no other artillery could get into action.

At Monastir, facility of transport on the back of mules, as well as the high trajectory, permitted these guns to accompany the infantry into action, taking cover behind very steep declivities.

THE ARTILLERY AT TCHATALDJA.

In advance of the principal line of resistance, the Turks placed their advanced line of infantry intrenchments on the spurs of Mahmoudie, Hamidie, Karakol, Nokta, &c.

Behind the intrenchments on each spur there were one or more field batteries, also intrenched, with cover for the gunners. (See plate.)

On the 17th November, the Bulgarian batteries established in concealed positions at Ezetin and on the heights north and south of Tchataldja opened fire on the Turkish batteries which were hardly able to answer but suffered no loss. In the meantime the Bulgarian infantry approached. The ground was covered by successive waves of infantry, but suddenly all were brought to a standstill suffering great losses from the Turkish batteries which had found their range.

At 3 o'clock in the afternoon another attack on Hamadie and Karakol Nokta was repulsed in the same way by the converging fire of the Turkish batteries.

The guns of three field batteries which accompanied the infantry attack were abandoned, the personnel being absolutely decimated.

During the night of the 18th, the Bulgarian infantry succeeded in taking cover in a long trench which was thrown up at somewhat less than a mile from Okluk Tabia.

On the 19th the Bulgarians tried to rise from the trenches but were hurled back by a combined fire of infantry and artillery.

The Turkish batteries continued to sweep the trenches with a frontal and a flanking fire.

During the night of the 19th the Turks captured the trenches at the point of the bayonet, when a large number of the defenders were found dead and wounded by artillery fire.

CONCLUSIONS.

1st. *The artillery duel is a necessity.*

The fire of the Bulgarian artillery against the infantry and artillery of the Turks was quite innocuous, both before and during the attacks.

Hence the Turks found themselves in as good a case as if they had gained superiority in the artillery duel, and could act with two arms of the service against one.

For this reason, their losses were small and those of their enemy were enormous.

There are further proofs that a frontal attack in open ground is sure to succeed if a definite superiority is obtained by the artillery beforehand.

On the other hand, it is absolutely doomed to failure if not to destruction where no such superiority has been obtained over the enemy's artillery which is still intact.

2nd. *Reasons for the want of success of the Bulgarian batteries*.

Why was it when the Bulgarians commenced the artillery duel, they obtained no result?

The Bulgarians did actually sweep the opposing batteries with shell.

The Turks estimated that at least 2,000 shell were hurled against the Mahmoudie Fort during the preparation and the execution of the attack by the enemy on the 17th. The shell came from three directions, nevertheless, only three or four gunners were put out of action.

It almost appears that if the personnel digs itself in under ground, nothing can be effected against that artillery, and that consequently the artillery duel is useless.

This conclusion would appear to be at variance with the experience of Monastir, which showed the possibility of putting out of action even artillery under cover.

The Turks attribute the inefficiency of the enemy's batteries at Tchataldja to the fact that the shell were fired with too great elevation and burst too high. Hence few of the shell were effective. Some fuzes that were picked up were found set for 5,600 and 5,800 métres (6,200 and 6,400 yards).

No field artillery gun is much use at these ranges, and a slight error in range renders the fire quite useless.

3rd. *The necessity for long range guns, with high explosive shells*.

In order to obtain superiority in the artillery duel, appropriate means must be taken.

The Bulgarian field artillery wihch could not advance under cover within efficient range of the Turkish batteries, could only effect anything against these latter if they were provided with long range guns.

The shrapnel fire also was useless against batteries in blindages; only high explosive shell would be of any use against them.

4th. *Superiority of, and necessity for, oblique fire.*

The Turkish guns firing direct against the Bulgarians were only at about a range of 1,500 métres (one mile), and the shrapnel could not reach the defenders shelters.

The only fire which was of any use against them came oblique to them.

SUMMARY AND SUGGESTIONS.

As it is often only at distances beyond the effective range of field artillery that there are positions which enable us to take the enemy in reverse or in enfilade, long range guns must be provided so as to obtain a superiority of fire.

The occupation of a position by field artillery in face of the enemy's artillery already in position and which has already made preparations to assume the initiative, will be an operation of a very dangerous character.

But if there is a sufficient number of long range guns under cover of which the advance may be made, the difficulties are much less.

The ground also may not permit all the field artillery to be brought up under cover and get into position, even in two lines, within effective range of the opposing batteries already in position. The only way the numerical equilibrium can be re-established is by using long range guns.

And these long range guns should in peace time be organized as a unit of the Army Corps, and be permanently attached to it.

Our resources in men and horses will not permit of an increase of these, hence it becomes necessary to replace a certain number of field batteries by long range heavy batteries.

These long range batteries having to act in conjunction with the lighter field batteries in the artillery duel, must be capable of getting into position at the same time as the light batteries, if not before them. They must also fire under the same conditions and with the same rapidity.

Hence these long range guns must be quick firers and easily moved on all sorts of ground.

The Servians have long 120 m.m. Canet guns of 1897 pattern. They are very heavy, drawn by bullocks and can only be fired on wooden platforms.

Despite the enormous difficulties of bad roads or no roads at all,

the Servians dragged them at the rate of 1½ miles an hour, marching night and day, into position.

The projectile should be some sort of shrapnel where the effect is not too local, enabling it to reach the personnel under cover, and it should besides be able to destroy artillery matériel.

The *universal* shell of the German artillery would appear to be the sort of projectile required. This shell the Germans have adopted for their light howitzers of 105 m.m.

In order to verify the range and to properly observe the effect of fire, everything points to the employment of aeroplanes specially attached to the artillery. The only means of *really seeing* is by using aeroplanes.

All batteries should at once be provided with observation ladders.

The Servians when in position found the range of all likely targets by means of trial shots, but this might prove a very inconvenient plan, and telemeters or other rangefinding instruments should be supplied.

In many cases, it was found impossible to move guns under fire with horses. Hence the necessity of providing man harness beforehand instead of having to improvise it during action.

These are not small points of detail, but are of very great importance in the service of artillery.

FIELD ARTILLERY QUESTIONS OF THE DAY.

LIGHT HOWITZERS IN THE FRENCH MANOEUVRES: A battery of 10.5 cm. (4.13 inches) Schneider-Creusot light howitzers was attached to a French division during the recent summer manoeuvres. The use of these pieces on that occasion throws light on the tactical role of this class of matériel. In carrying out the order to support the attack, it took up a position behind a fairly steep slope. The 75 mm. batteries were located nearer the crest on a gentler slope. The common target was the hostile infantry which, however, gained ground, and was soon defiladed from the fire of the field guns, and these were compelled to suspend their fire and change their position. The howitzers, although defiladed by a considerably higher mask, were able to continue their fire without interruption. Some time later it was able to reach with its fire the very bottom of a sheltered valley, and conduct fire for demolition against the hostile position as well as supporting the infantry during its entire march of approach. In this instance the battery commander located his observing station in the second story of a house 300 meters from his battery with which he communicated by signal.

On another occasion this howitzer battery pushed forward to the lee of a captured village where it was protected by the houses against both rifle and machine gun fire, and to a considerable extent against hostile artillery. The howitzers were able to fire over the houses, and being close to the infantry line, without unduly exposing themselves were able to afford all the material and moral support to be expected from accompanying batteries. In many other instances they were used practically the same as the light field guns.

These episodes of the maneuvres, all entirely unpremeditated, seem to demonstrate beyond question the utility of the light howitzer, either to support an infantry attack or engage artillery. They show that howitzers can get into action immediately, where with guns considerable time would be consumed in finding a suitable position. Even granting that such a position existed within a reasonable distance, the infantry would still be left for a certain interval without support, or else the artillery must necessarily be exposed to fire, to which it could not reply.

HEAVY FIELD ARTILLERY IN THE FRENCH MANOEUVRES: A platoon of 10.5 cm. Schneider-Creusot heavy rifled field guns were lately used in the French manoeuvres as an experiment. These pieces fire a projectile weighing 35 pounds, with an initial velocity of 1886 f. s. The piece in battery weighs 4350 pounds; limbered, its weight is 5390 pounds. Their mobility was considerably greater than the 155 mm. howitzers. In one instance when their presence was urgently needed, they trotted 5 kilometres in about 30 minutes.

NEW SIEGE MATÉRIEL: The French firm of Schneider & Co. has recently turned out a new 21 cm. (8.27 inches) siege howitzer. The improvement in this class of ordnance is best shown by a comparison with the French 22 cm. siege mortar, model 1880.

	22 cm. Mortar model 1880		21 cm. siege howitzer	
Weight of projectile	216	pounds	216	
Muzzle velocity (maximum)	853	f.s.	1100	f.s.
Extreme range	5200	meters	8500	meters
Weight of gun wagon	8110	pounds	8530	pounds
Weight of carriage wagon	9411	pounds	8585	pounds
Weight of platform wagon	9323	pounds		
Total weight	26844	pounds	17115	pounds

This comparison is, of itself, sufficiently striking; but, in addition, we must remember that the mortar cannot be fired until the platform is laid while the howitzer can go into action anywhere, and can fire two shots a minute. The greatest speed to be expected from the mortar is three shots in two minutes.

JAPAN ADOPTS THE FOUR-GUN BATTERY: Japan has recently decided to change her field artillery organization by adopting the four-gun battery. The 36 guns of which the regiment is now composed will be divided into 3 battalions of 3 batteries of 4 guns each, consequently, the ratio of guns to bayonets will not be decreased.

ARTILLERY AMMUNITION EXPENDED BY THE BULGARIAN ARMY DURING THE BALKAN WARS: The Bulgarian General Staff has recently published information concerning the expenditure of artillery ammunition during the recent hostilities in the Balkans. It seems that at the beginning of the war there were on hand approximately 1,000 rounds per gun, and this supply was increased during the progress of hostilities both by purchase and capture. The expenditure during the Turkish War averaged between 450 and 500 rounds per gun. In some cases it ran as high as 800 rounds. Including both the Turkish and the Servian-Greek Wars the total expenditure by the Bulgarian guns averaged 1,076 rounds.

At the conclusion of the latter war there remained on hand as little as 40 rounds per gun, notwithstanding the utmost economy which marked the latter stages of hostile operations.

For the future the Bulgarian General Staff has planned to keep on hand 1,500 rounds per gun.

GREEK ARTILLERY: Greece has recently placed an order with Schneider & Co., Creusot, France, for 50 new batteries.

MEXICAN ARTILLERY: The Diario Official is authority for the statement that Mexico will create five additional regiments of artillery as soon as the material therefor is received from abroad.

GERMAN AND FRENCH TRAINING IN EASTERN ARMIES: It is stated in La France Militaire that 44 officers of the German army, including one general, will be in charge of the reorganization and instruction of the Turkish army. On the other hand French officers have been engaged by the Greeks and will be placed at the head of the model instruction regiments of the Greek army.

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ANNUAL MEETING OF FIELD ARTILLERY ASSOCIATION

The annual meeting of the United States Field Artillery Association was held December 23, at 11 o'clock. There were present in person or by proxy 169 members, a majority of the total membership.

Reports of the Treasurer and Secretary were submitted.

Lieutenant Colonel P. C. March, Adjutant General (Field Artillery) and Major W. J. Snow, Field Artillery, were elected members of the Executive Council to fill expired terms.

It was resolved to reduce the price of subscription to the FIELD ARTILLERY JOURNAL to $3.00 per annum. It was also resolved that ex-editors of the FIELD ARTILLERY JOURNAL shall become life members of the Association.

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