NOTES ON

INFANTRY, CAVALRY *and* FIELD ARTILLERY

LECTURES DELIVERED TO CLASS OF
PROVISIONAL SECOND LIEUTENANTS
FORT LEAVENWORTH, KANS.

1917

SPECIAL REPRINT FOR OFFICERS' TRAINING CAMPS

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PART I

NOTES ON INFANTRY

LECTURE DELIVERED
JANUARY 29, 1917

By

MAJ. H. B. FISKE

NOTES ON INFANTRY.

GENERAL PRINCIPLES.

In beginning the study of infantry tactics we must note, first, that in a modern engagement the decision is reached when the infantry of one side concludes it is beaten and leaves the field of battle. A victory is won not by the actual destruction of the enemy, nor usually of any great fraction of his strength, but by so shaking his nerves and breaking down his will as to convince him that further resistance is useless. The chief element in forcing that conclusion upon him is the infantry of the victor; next in importance is the infantry's great assistant, the artillery; the cavalry further assists by reconnaissance, by giving warning of changes in the enemy's dispositions, and sometimes by directly intervening on the field of battle. As a consequence, infantry not only forms the bulk of any army, but constitutes also the framework upon which all other arms are proportioned. If the infantry of an army is of high quality, that army will go far; if its infantry is poor, the army is poor, no matter how excellent all the remaining services may be. The best army, of course, is the one in which all branches attain a high and evenly developed efficiency. Since all other arms must base their action upon and coordinate it with that of the infantry, all officers, in whatever branch they may be, must be familiar with the fundamental formations and dispositions of infantry, if their own arm is properly to perform its function.

Next, it must be remembered that only by attacking can decisive results be obtained. If we remain on the defensive, we may delay the advance of our enemy, and so gain time perhaps for help to come up, or we may postpone and even ultimately prevent a hostile victory; but we can never be victorious ourselves unless finally we attack. The boxer who can only parry and block but can himself drive home no powerful blow has little chance of any decision better than a draw; and the army that only defends can at best get no more than a drawn battle, and it usually has little chance of even that indecisive result. The offensive spirit, the desire to advance, the determination to attack must be strongly implanted in the army that wages successful war.

While to attack is necessary if decisive results are to be obtained, for the troops directly concerned to attack is much harder than to defend. Every improvement in the range of firearms has made a wider zone over which the attacking infantry must pass under fire

in order to close with its enemy. Modern history consequently affords many instances in which troops with little training, and even with little discipline, have given a fair account of themselves on the purely passive defensive in trenches where, once placed, no further maneuvering was necessary. But recent history also shows that the attack, on the other hand, makes the most extraordinary demands upon the skill, training, and discipline of the infantry that carries it to a successful conclusion.

Since only by the attack can decisive results be obtained, and since the attack is the most difficult operation that the infantryman is called upon to perform, I propose to talk to you this morning only of it, neglecting entirely the much simpler defensive and all of the various means adopted to provide for the security of troops while on the march and at rest.

History teaches us that improvement in weapons must be accompanied by a constant modification of tactical formations. The Greek masses, which were suitable for meeting the attack of Persian hordes, would be fatal in front of a single pair of machine guns. The supporting lines of our Civil War, which, with comparative immunity, maneuvered in close order not far behind their skirmishers, to-day, because of the flat trajectory of the modern rifle, would quickly be destroyed by the shots which had missed the firing line. As the range of weapons and rapidity of fire increase so that death can be dealt out to many at greater and greater distances, formations for attack continually grow more open in order to afford poorer targets for the defender's fire.

Not only is it necessary to consider the physical effect of the hostile fire in determining upon the formations best adapted for advancing under that fire, but it is necessary as well to consider the effect of the formation upon the minds of our men and the minds of the enemy. A dispersed formation gives the enemy poor targets, and therefore makes it harder for his fire to obtain any physical results. But in dispersed formations many of the men are not directly under the eyes of their officers. Human nature, which is always at work in each individual trying to persuade him to lie still and let somebody else go ahead to do the hard fighting, has in such a formations better chance of overcoming the will. This mental factor, therefore, is better met by a close formation, in which the will of the individual is supported by the example of his officer and of his comrades. The close formation has frequently, also, a depressing effect upon the morale of our enemy. We find, accordingly, that certain European regulations of 1916 counsel the assault in lines shoulder to shoulder and at no faster gait than permits perfect alignment, because of the vastly greater effect such an orderly advance will have upon the nerves of the defenders. To return to the physical factor again, in

order to give our own fire the greatest possible effect dense skirmish lines are required; while, as we have seen, thin lines furnish the poorest targets to the enemy. It is evident, therefore, that the formations in use at any tactical period are largely in the nature of a compromise between conflicting requirements.

HISTORICAL REVIEW.

This will perhaps be best illustrated and the general effect of improvements in weapons be best shown by a short historical review of the attack formations of infantry. The two great means for the defeat of the enemy are fire and shock. Up to a certain point effective fire demands an extension of front; shock action, on the contrary, demands a narrow front to produce a deep mass. With increases in the range of weapons, and therefore in the value of fire action over shock action, formations have grown thinner and more open, until this tendency reached an absurdity in the dispersed deployments of the English in the Boer War.

During the Dark Ages infantry was in an entirely subordinate position. Its members were of the dullest classes, poorly clothed, and generally armed only with the sword or spear. Naturally, they were at the mercy of the heavily armored mounted knights. But with the advent of the English archer and the development of the crossbow in the continental armies, the supremacy of the mounted man began to diminish; and the discovery of gunpowder, making possible the penetration of the knight's heavy armor at some distance, promptly brought the infantryman back to an at least equal tactical footing.

To enable a greater proportion of the men to use their pieces, it was soon found necessary to decrease the number of ranks, and this decrease at the same time served to furnish a poorer target to the enemy's infantry and artillery. Gustavus Adolphus formed his Swedish infantry in six ranks; each company had its pike men in the center and its musketeers on the two flanks. The six ranks were reduced to three upon deployment.

During the wars of Frederick the Great, the musket had an effective range of only 100 yards. Yet, even with that short range, fire began to take its place as the great battle factor and to relegate shock action to the secondary rôle in which it is found to-day. The Prussian armies of the great Frederick paid the utmost attention to a high discipline, to accurate and flexible movements, to quick loading, and the development of a rapid and accurate fire. Notwithstanding his cumbersome piece, the individual is said to have been capable of six shots per minute—as high a rate as we find expedient to-day with our magazine rifle.

In 1810 the English reduced the number of ranks to two, which as you know, is to-day the rule for close order movements; although it has long ceased to appear on the battlefield.

By the Napoleonic period the musket had attained an effective range of more than 200 yards.

Skirmishers, in the shape of light troops, have always had a place on the battlefield, and an extensive use of them against savages was made by the early settlers in the United States. But the first great use of skirmishers in civilized warfare as the important element in fire preparation for the assault is found in the French armies of Napoleon. By fire preparation is meant to shake the enemy's nerves and lower his morale by inflicting losses upon him in the fire fight.

In the early Napoleonic years the French swarms of skirmishers, taking full advantage of the ground to avoid losses, warmly engaged

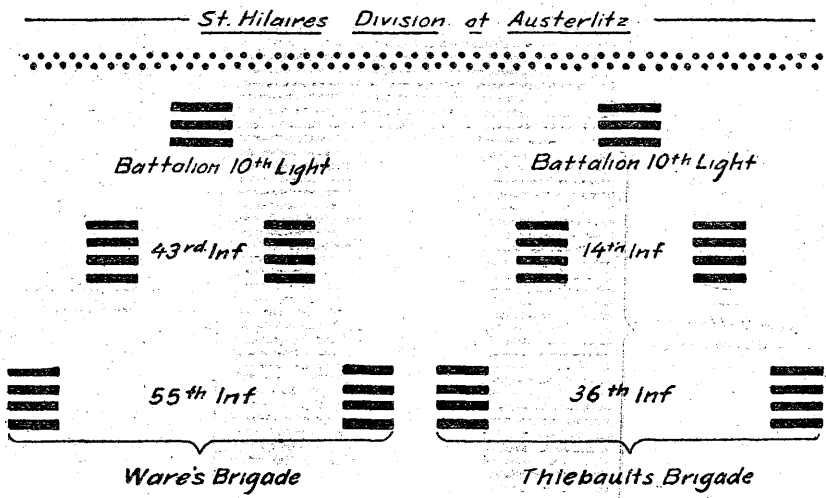


Fig No I.

(From Wagner, O&T p 86)

the defender's infantry at effective ranges. Small columns, usually battalions in columns of companies, followed the skirmishers just beyond the effective range of the enemy's rifles. When the defender's lines had been sufficiently shaken by the skirmisher's fire, these columns of attack marched through their skirmishers and assaulted with the bayonet. Not only did the steady advance of such columns have a depressing moral effect on the defenders, but like a massed formation at football, the column was prepared to break down the enemy's resistance and penetrate his formations, by the sheer shock and weight of the deep mass. In the column, too, once started, the whole tendency was to go on; the more timid were carried ahead by the close contact and example of their braver companions, and the officers

had their men close at hand and under easy control. For the weapon of this period, these dispositions of the French constituted an excellent compromise in the constant conflict between requirements for fire effect and for shock action. Figure 1 shows the formation of St. Hilaire's division at Austerlitz in 1805, when the French Army, in training, skill, and discipline reached its high mark.

After 1806, the quality of the French troops rather steadily deteriorated as a consequence of shorter periods of training, and the inclusion in the ranks of half-hearted recruits from the conquered countries. With this decrease in quality, came a diminished ability to skirmish, which depends so much upon the training, skill, and character of the

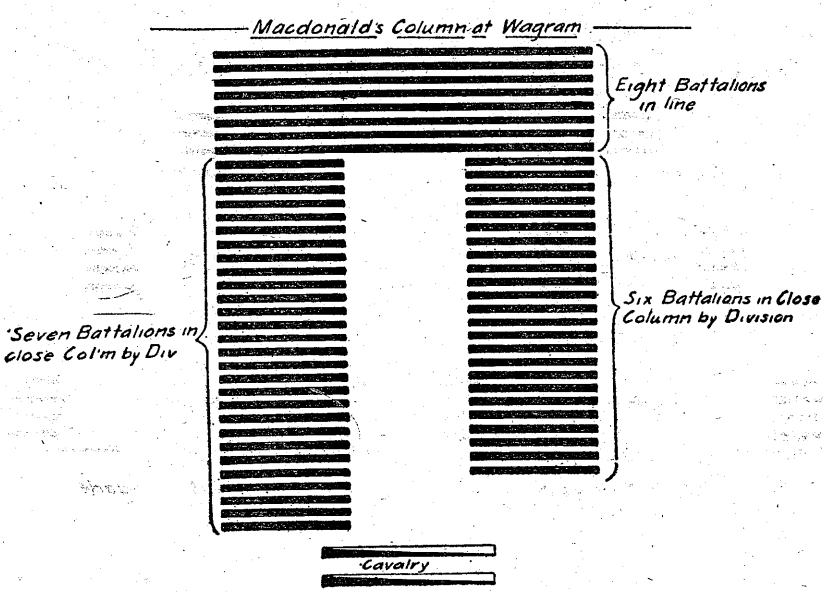


Fig No 2

(From Wagner O & T p 89)

individual soldier. Accordingly, battles were more and more decided by the shock action of great columns of attack, in which the unwilling recruit could be herded forward by his officers and comrades.

The use of heavy columns by the French culminated in the remarkable formation of Macdonald's corps at Wagram, which is, perhaps, the most famous column of attack mentioned in military history. Eight battalions were deployed in line, one behind another at close distance, while on the right flank six, and on the left flank seven, battalions were formed in heavy column, each battalion in close column by division. The rear of the square was closed with cavalry. This column broke the Austrian line, though at the cost of enormous losses on its own part. (Wagner O. & T., p. 89.) See fig. 2.)

By the time of the American Civil War the rifle, with an extreme range of more than 1,000 yards had generally replaced the smooth

bore musket. Toward the end of the war some of the Northern troops were armed with breech loaders. The formation of French's division at Fredericksburg may be taken as typical of the attack formations of that war. (See fig. 3.)

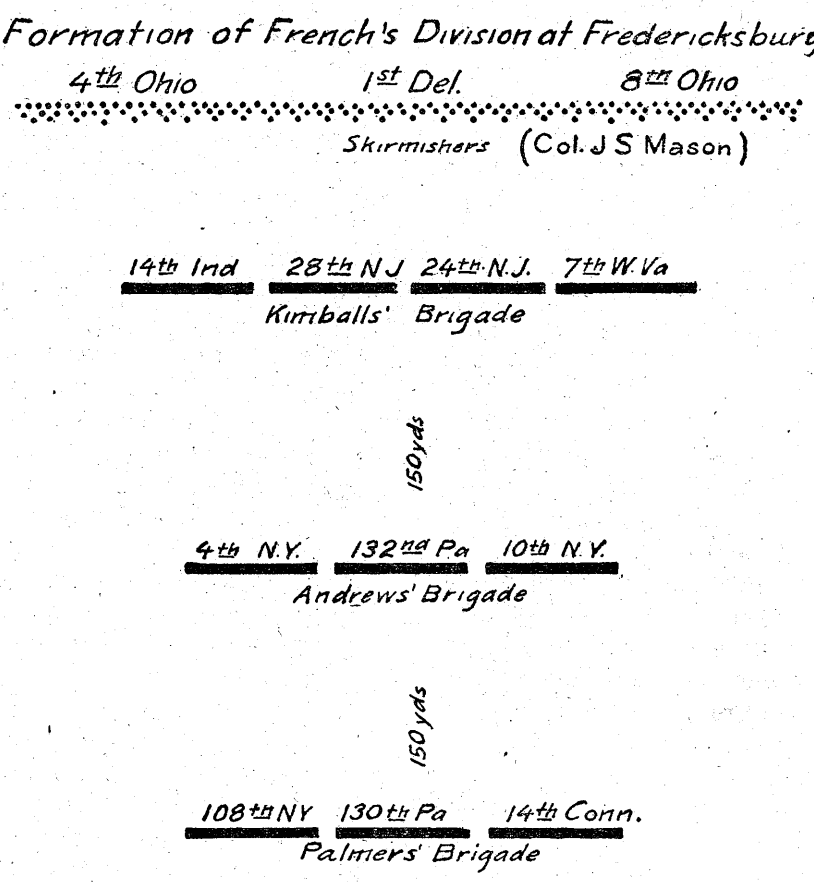


Fig No. 3

Kimball's brigade was in advance, deployed in line of battle (double rank, close order): Andrew's brigade, in similar formation, followed at a distance of about 150 yards; and at an equal distance and in the same formation, Palmer's brigade formed the rear of the column. The head of the column was covered by three regiments deployed as skirmishers. (Wagner O. & T., p. 97.)

The great fault of this formation lay in placing one brigade behind another instead of two or more abreast. Our tacticians of that time did not understand how to obtain supports and reserves for their first lines without producing an excessive mixing of units. But in reality any proper formation in depth was rendered impracticable by

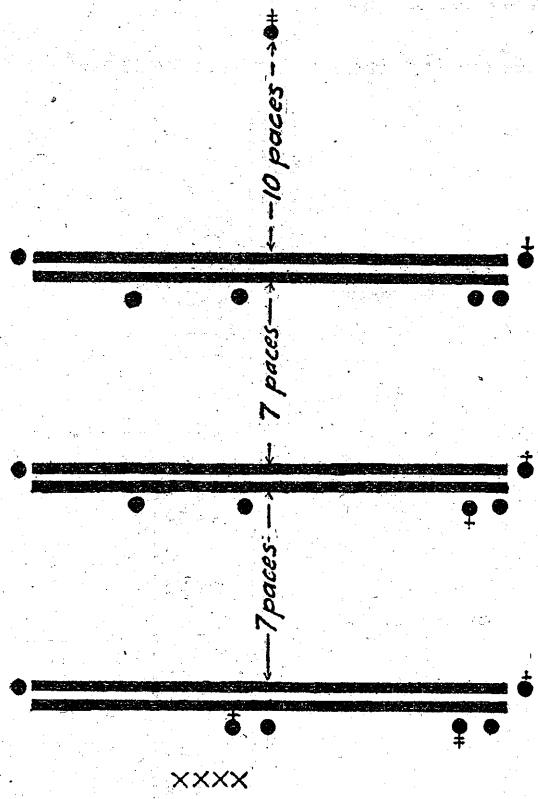
the absurdly small size of all organizations. When French's leading lines were checked, the succeeding lines crowded forward into the first, so that finally the assault was made by a line of skirmishers, six or eight men deep, in which all organizations had been merged and their identity lost. The division thus passed beyond any real control by its higher officers, becoming little better than an unmanageable mob. We shall later see how the attack formation of to-day attempts to avoid this mixing of units.

During the war, the line of skirmishers became the customary formation for fire action, taking the place finally of the double rank line of battle. The habit of hasty entrenchments was acquired and carried to almost as great an extent as in Europe to-day.

In the War of 1866, between Prussia and Austria, Prussia was armed with a breechloader, Austria with the old muzzle-loader. In the one decisive battle of that war, Prussia attacked with its first line companies in close column of platoons (company column), covered by skirmish lines. The Austrians in similar close formations attempted to oppose the terrible Prussian fire by advancing without firing to assault with the bayonet; that is, the Austrians attempted to defeat a combination of fire action and shock action by shock alone. The fearful losses produced by the Prussian fire were more than the Austrians could endure.

In 1870 against France, the Germans had their needle gun, with an effective range of about 600 yards, against the French chassepot, with an effective range of 1,300 yards. Moreover, in this war the machine gun made its first considerable appearance and on the side of the French. The Germans, who always attacked, had to advance for six or seven hundred yards under a fire to which they could make no reply. And they attempted to do this in the earlier days of the war in company columns, the mixed fire and shock action of which had proven so successful against the purely shock action of the Austrians. (See fig. 4.) The Prussian formation, better adapted for shock than for fire, was lagging behind the progress in firearms, a mistake for which there was bitter payment. The awful losses that resulted from the use of these heavy formations is well illustrated by the experience of the Guards at St. Privat. The attack was made over perfectly open ground to extreme range. Each regiment formed in two lines, the first of company columns, the second either of company columns or half battalion columns. The troops rushing forward under the murderous French fire lost all cohesion. The remnants of the Kaiser Franz Regiment got within 500 yards of the French lines, where they halted in a confused line, lay down, and engaged in an indecisive fire fight. The other regiments had practically the same experience. In 10 minutes the three brigades of the Guard division lost 6,000 men.

Prussian Company Column



Captain
Lieutenant
Port peefahnrich
Feldwebel
Vice Feldwebel
Sergeant
XXXX Field Music

Fig. No. 4

(From Wagner, O & T, p. 103)

But the Germans very promptly learned that the day of close order formations under effective fire was a thing of the past, and devised formations which could live under the French fire. The attack of the Kaiser Franz Regiment, at Le Bourget, later in the war, has been described as follows (see fig. 6):

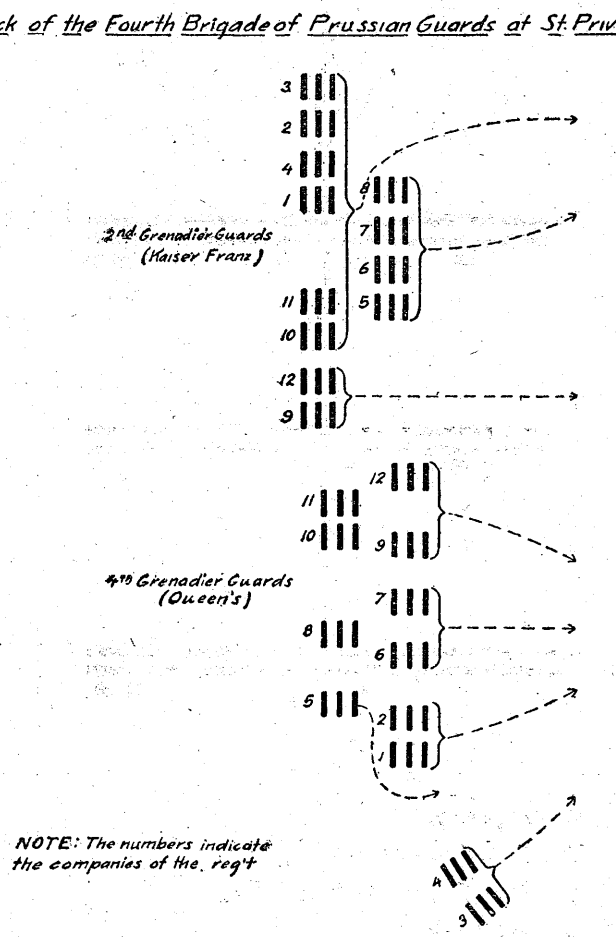


Fig. No.5.

(from Wagner, o.c. p. 106)

At this point there were two battalions of the Franz Regiment who had to attack over 2,000 paces of open ground. The officer commanding this regiment had already practiced it in the attack. In accordance with his practice, he sent forward the whole of the leading line, which consisted of two companies, in thick swarms of skirmishers, and made the advance over the open ground in two parts (by wings) which alternately ran in 300 paces. After each rush the whole of the wing which made it threw itself down, and found some cover among the high potatoes; there

they recovered their breath while the other wing rushed in. As soon as they arrived within range of the needle gun, the wing which was lying down opened a fire of skirmishers on that edge of the village which they were attacking. I can still remember as I write the delight which we felt as from our position we watched this attack, which had been so carefully thought out and was so well carried through. The best of the thing was that, as the commander of the regiment assured me, these troops suffered no loss up to the time when they reached the edge of the village. (Hohenlohe, Letters on Infantry.)

The Franco-Prussian War thus produced the advance by rushes under the covering fire of sections of the line, and in Europe estab-

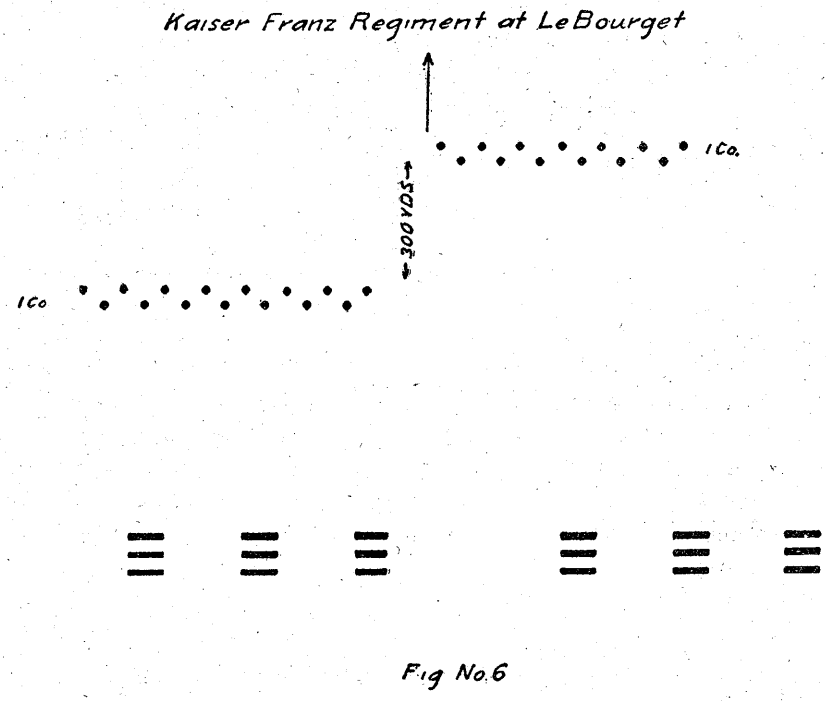


Fig No. 6

lished the heavy skirmish line as the only formation for fire action, a principle that the American had learned in the Civil War.

The Boer War of 1899 found both sides armed with high-powered magazine rifles. The English, accustomed in their little wars to overrun poorly armed savages with comparative ease, were surprised by the intensity and effect of the Boer fire. To minimize losses, they promptly went to an extreme in dispersion, even attempting at times to attack with intervals of 10 to 15 yards between skirmishers. These thin lines could develop little fire, the men were not under control, and the lines had no weight for shock action; that is, for assault with the bayonet.

The Germans, in 1870, like our commanders in the Civil War, found difficulty in maintaining order and control when closely engaged. Because organizations were frequently supported by other

organizations, by the end of the fire fight there was an unnecessarily heavy skirmish line, which consequently suffered disproportionate losses, and a bad mixture of units, with consequent loss of control. Since 1870 the Germans have made an exceedingly careful study of their experiences in that war, and have attempted to deduce the causes for poor results with those formations which proved unsatisfactory, and to decide upon those which promised the best results. To determine what formations are best adapted for advancing under different kinds of fire, they have not only carefully investigated the mathematics of the problem, but have tested the conclusions therefrom by prolonged firing tests at dummy figures. Then, they have attempted from these tests and their actual experience in war to deduce principles to govern their infantry officers in minimizing the mixing of units and the production of disorder, and for the maintenance of the needful amount of control by the officers.

After the Boer War many French and English military writers, and some few Germans urged that it was impossible for troops to live in front of intrenched positions in any but the widest deployments. German authorities, however, were not stampeded by such notions. They realized the necessity during the decisive fire fight for a strong firing line to beat down the enemy's fire; they believed that, with artillery and machine guns assisting the infantry rifle, it was possible to gain this superiority of fire even over entrenched troops; and that strong additional echelons must be behind the firing line to replace losses and make the assault. The Japanese, in the Manchurian war against Russia, employed the German methods throughout; and were highly successful, not only against strong intrenchments, but frequently against such when held by superior numbers.

PRINCIPLES OF AMERICAN DRILL REGULATIONS.

Our present Drill Regulations are based almost entirely upon the observations and conclusions of Gen. Morrison of the United States Army, who accompanied one of the Japanese field armies in that war. Briefly, the ideas and principles upon which the Drill Regulations are based are somewhat as follows:

In the first place, what the infantry are trying to do when attacking must be kept in view. They are not trying to shoot the enemy out of his trenches or his position. To do so is hardly a possibility; even the poorest troops will stick under fire alone. To get the enemy out, the whole idea of the infantry attackers must be to close with the enemy, personally to get at, and end him with the bayonet. Frequently the stage of the bayonet attack is not actually reached, because the nerves of one side or the other give way before; but in any successful attack it is the continued advance that finally con-

vinces the enemy the attackers can not be stopped and that consequently causes him to desert his position.

Since the great purpose of the infantryman is to close with his enemy, it may be said that his battle tactics should consist of no more than a rapid orderly advance without halts and without firing. But modern firearms, with their flat trajectory, wide danger space, great accuracy, and tremendous volume would cause such losses during the considerable period in which the advance would receive their fire that the most iron discipline would not suffice to carry the attackers on; or if they did succeed in closing, there would be few men left for the bayonet fight. The Austrians, as we have seen, tried this idea of shock action only against the Prussians in 1866, but simply with disastrous results to themselves.

FIRE SUPERIORITY.

How then can the advance be made? The answer to this question is found in the second great tactical principle—the doctrine of fire superiority. By the effective use of our own fire from the infantry rifle, the machine gun, and of our artillery, we must cause the enemy such losses that his nerves will lose their steadiness and that consequently his fire, instead of resembling in accuracy that done on the target range, will become wild and ineffective. When we have so beaten down the enemy's fire, our advance can be resumed with comparatively little loss. In order to make a successful attack to-day, the infantry must go forward under the protection of fire.

ENVELOPMENT.

How can the attacker, who usually advances over open ground against an enemy who is sheltered behind a parapet, obtain this superiority of fire? It must be done by superior artillery, by better shooting upon the part of the infantryman, and by an enveloping form of attack. By enveloping one or both flanks the attacker will have a longer line, can therefore find room for more rifles in his firing line, and his fire will be convergent; while the enemy's will be divergent and consequently less effective. Even when making an enveloping attack, however, the attack locally will seem to those participating to be a purely frontal one. If the enemy knows even the rudiments of the game, we are never going to be able to get squarely on his flank and unopposed shoot down his line. He will certainly deploy supports or reserves in time directly to meet the attacker's enveloping troops. But such supports or reserves will probably not be entrenched and will have perhaps nothing like the strength opposed to them. For example, if a regiment is attacking, with one battalion enveloping the enemy, the latter, very likely, can bring only one company to meet this battalion. The four com-

panies should quickly overrun the one company and the whole regimental attack will then succeed because of the successful attack by the enveloping battalion. Figure 7 shows in black an enveloping attack upon the original hostile line A–B. C–D indicates reserve deployed to meet the envelopment.

From the foregoing it may be seen that fire to-day is ordinarily more important than shock. Our formations, therefore, must favor the development of a strong volume of efficient fire, but these formations must not favor fire to the extent that our troops at the end are incapable of powerful shock action.

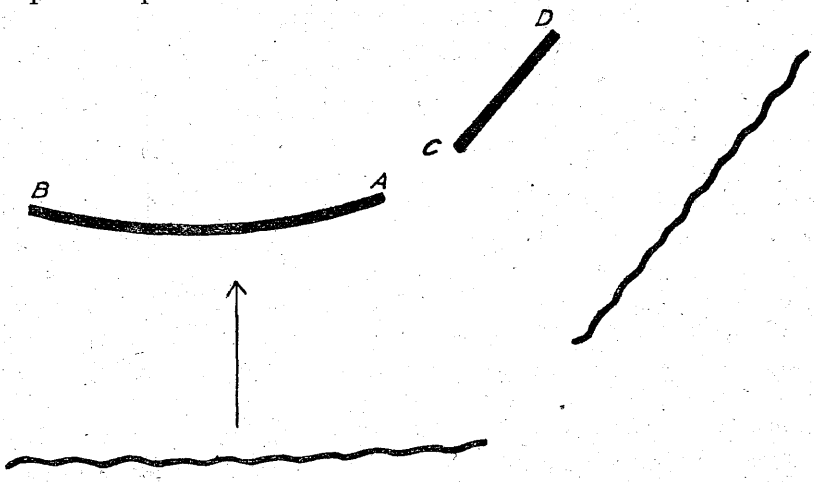


Fig No. 7

ADVANCE UNDER ARTILLERY FIRE.

Let us start with an attack when the infantry first comes under the fire of the hostile artillery. If the defenders can observe the burst of their projectiles, either from aeroplanes or from suitable high points, the hostile artillery will be effective when our infantry is two or more miles from the defender's trenches. The attacker's artillery must search for the hostile artillery, engage it, and render its fire on the infantry as ineffective as possible. But the enemy's artillery will not be entirely silenced; the attacking infantry will almost certainly be compelled to advance under it for several thousand yards. The infantry can not help by its own fire because the hostile artillery, which in the first place it can not see, is so far away that any rifle fire would be totally ineffective and would simply entirely waste extremely valuable ammunition. What then can the infantry do? The answer is, nothing directly against the hostile artillery. It must bear its losses and continue its advance, adopting those formations

which offer the enemy's artillery the poorest targets, and taking every advantage afforded by the ground to obtain cover from the enemy's view.

Remember that the hardest formations for artillery to hit are small narrow columns. Our platoon column is excellent for use during this stage, both because it is hard to hit, and also because it is well adapted to taking advantage of the small folds and bits of cover to be found on the most open ground, as well as for retaining control of the men. The squad column is not good because adjacent columns are so close together that a single shrapnel, whose burst is about 20 yards in width, might hit two columns. The thin lines of our drill book are frequently best for filtering men across an open space, because the enemy will probably not waste ammunition by firing on such a target, since even a successful shot could hardly hit more than one or two men. But thin lines have the serious defects that the advance in them is very slow, and the men pass almost entirely from the control of the officers. Any line of columns should be staggered; that is, the heads of columns should not be abreast. If properly staggered, one column will be many yards closer to the enemy than the adjacent column; yet, from the enemy's viewpoint both will appear to be the same distance away. He will, consequently, range on one and open fire for effect on both with one range, which will then perhaps be incorrect for one column by hundreds of yards. Remember also that rapid and irregular motion greatly hampers the enemy's artillery both in ranging and in firing for effect. The advance under artillery fire constitutes a series of nice problems for each company, and to a lesser degree for each platoon, commander. Each exposed piece of ground to be crossed furnishes a new problem, requiring an estimate of the manner in which the enemy's artillery will oppose the passage of our infantry, and a decision whether to use thin lines, or a line of columns, or to cross by rushes in the normal line of skirmishers. If the responsible officer decides incorrectly, he, very likely, sacrifices several valuable lives to his error of judgment, and a few such mistakes will result in losses that will bring his attack to a standstill.

FIRST FIRING POSITION

Somewhere within, say, 1,500 yards on very open ground, the enemy's long-range infantry fire also begins to be felt. The natural desire of all men is to shoot back at the men that are shooting at them; but this tendency must be resisted. At 1,500 yards a properly intrenched enemy can not be seen; fire at that range would, accordingly, simply comb the scenery, and ammunition, which ordinarily can not be replaced during the day, will be thrown away. To open at 1,500 yards on unknown ground would simply result in an ineffective fire, which, instead of lowering the enemy's courage, would

induce contempt for the attacker's fire and so increase the courage and confidence of the defender. The attacker, without replying, must now continue his advance under both infantry and artillery fire until he reaches a position so close to the defender that his fire will be effective from the start. That position must be well within 1,200 yards of the enemy and should be within 600 yards if the men can be controlled so long. Under 600 yards individuals of the enemy can be seen and aimed at. Fire must be opened by order before the men take the bit in the teeth and open without orders. From 1,200 or 1,500 yards in platoon columns are no longer of value on open ground, because they offer excellent targets to machine guns and more than one casualty may result from a single bullet. Thin lines occasionally may fail to draw the enemy's fire. Usually, however, the advance for the last 300 or 400 yards before opening fire will have to be made in skirmish lines at two or three paces, and by rushes from one small ground fold to another. Good troops will disregard their losses and reserve their fire until a suitable first firing position is reached.

This firing position must be selected with care. Usually, there can be found some natural position, like a ditch or a low ridge, which will afford cover for the greater part of the men's bodies. There, a heavy skirmish line, one man to the yard, or even to two-thirds of a yard, must be quickly built up. Up to this point, all formations have been selected with the main object of avoiding losses. Now, the main purpose becomes to inflict the utmost possible loss upon the enemy, thus beating down and rendering his fire ineffective. For this purpose no formation for the firing line is suitable but the heavy skirmish line.

Fire, when opened, must be as powerful and effective as possible, not only for physical results but also to obtain the maximum moral effect. To be effective at once, fire must be opened systematically. Battalion commanders must be sure that companies in the firing line understand just what portion of the enemy's position is to be sprayed by the fire of each company. Captains assign objectives to their platoons. Platoon leaders divide objectives among their squads. In each squad, the men distribute their fire evenly over the assigned target. In the company, it is usually advisable for each platoon to spread its fire over the target of the half company, so that, when part of the company is making a rush, the enemy's fire will be kept down by the remainder. This systematic distribution of fire can only be secured as the result of long training and splendid discipline, Unless troops are possessed of these high qualities, they will simply open a wild, uncontrolled fire, which will do the enemy little damage, while the attackers will suffer severely and their attack will get nowhere.

DECISIVE FIRE FIGHT.

As soon as the lessened effectiveness of the enemy's fire indicates that the attackers have gained the superiority, the advance is continued by alternate rushes of portions of the line, most frequently perhaps by platoons, under cover of and supported by the fire of the rest of the local line. This stage is the crucial one of the fight. If the troops have the skill and discipline to rush without losing the fire superiority, they will be able ultimately to reach a position close enough to the enemy's trenches for one united rush to put them over.

The manner of carrying through the final phase, that of the assault, will probably be clearer after consideration of the duties and functions of the troops that follow the firing line.

FRONTAGES.

Some such question as the following is frequently asked: An American brigade contains, roughly, about 5,000 rifles. Since for the decisive fire fight about one man per yard is put into the firing line, why should not the brigade properly deploy upon a front of 5,000 yards, or nearly 3 miles? If a brigade were so deployed it would become simply an armed mob, beyond the control of any but junior officers and utterly incapable of any maneuver to meet the unforeseen, which is almost certain to come at some time on the field of battle. A single troop of cavalry charging down on one of its flanks might easily run a mile or more of this long single line from the field; no commander above the grade of captain would be able to exert any influence on the further progress of the action; he would have no one to throw into the firing line to replace casualties; or to push some local success; or to stop some portion of the line that was being driven back; or to meet a hostile attack on the flank of the line. Instead of the 3 miles suggested above for deployment, our brigade properly attacks upon a front only of from 800 yards to 1 mile. The firing line then of the brigade will probably contain not more than a thousand rifles. What use is made of the remaining 4,000 rifles?

FORMATION IN DEPTH.

They are arranged in several echelons behind the firing line, the nearest only a few hundred yards away, the farthest perhaps a couple of thousand yards back. Each of these echelons has quite distinct functions to perform. The firing line itself, which is the echelon nearest the enemy, prepares the enemy for assault by inflicting the heaviest possible losses upon him, and so shakes his nerves and lowers his courage that he can be defeated in the bayonet fight. The second echelon supports the firing line, that is, feeds in men to replace its losses and so maintain it at full strength during the

fire fight. In addition, the presence of these supports close at hand and the reinforcements which they send forward from time to time, encourage the firing line, maintain its morale, and drive it forward. The third echelon joins the firing line, or is only a few yards behind it at the moment of assault, to furnish the necessary impetus and give the charging troops sufficient strength for throwing the defenders bodily out of their trenches. Still a fourth echelon is required to relieve the badly mixed and disorganized units that have made a successful assault, protect them while they reform and reorganize, and hold the ground that has been gained against the enemy's counter attack; or, if the attack does not succeed, cover the beaten attackers while rallying or withdrawing. In addition, each echelon must secure the flanks of the preceding echelon and has other duties of minor importance. All of these functions in the decisive attack require five times as many men as are originally put into the brigade firing line.

DEPLOYMENT OF BRIGADE.

Perhaps the use of these various echelons will be made clearer by a picture of a possible deployment of an American brigade for a decisive attack. Now, because the brigade is shown as attacking in this manner, do not get the impression that this is the way it will always attack. There is no principle of our drill regulations so constantly insisted upon as the one that on the battlefield we must have no set forms; but that, on the contrary, every situation must be solved upon its merits and the attack be made in the manner that best meets the conditions of the particular problem. In this case, the brigade is taken as it might form, with friendly troops on both flanks, for an advance over fairly open ground. Its firing line has passed through the zone of artillery and long range infantry fire to its first firing position, where it is heavily engaged in the struggle for fire superiority. (See fig. 8.)

You will note here the four customary echelons: first, the firing line; second, the supports; third, the regimental reserves, primarily for shock action; and fourth, the brigade reserve, to hold what is gained. The total front of the brigade is 1,000 yards. Two regiments are deployed, and the third is in brigade reserve. Each first line regiment is attacking with two battalions, holding one in reserve. Each first line battalion has in the firing line two companies, each entirely deployed at one man per yard; and the battalion has two companies in support. The supports and regimental reserves are shown in staggered lines of platoon columns; the brigade reserve in lines of columns of fours. The formations adopted, whether those shown or some other, of course, will depend entirely upon the fire they are receiving and the cover afforded by the ground.

Compare this picture of our present day attack with that of French's division in the Civil War (fig. 3). When French's massed skirmishers assaulted, at any point in the line there would be found

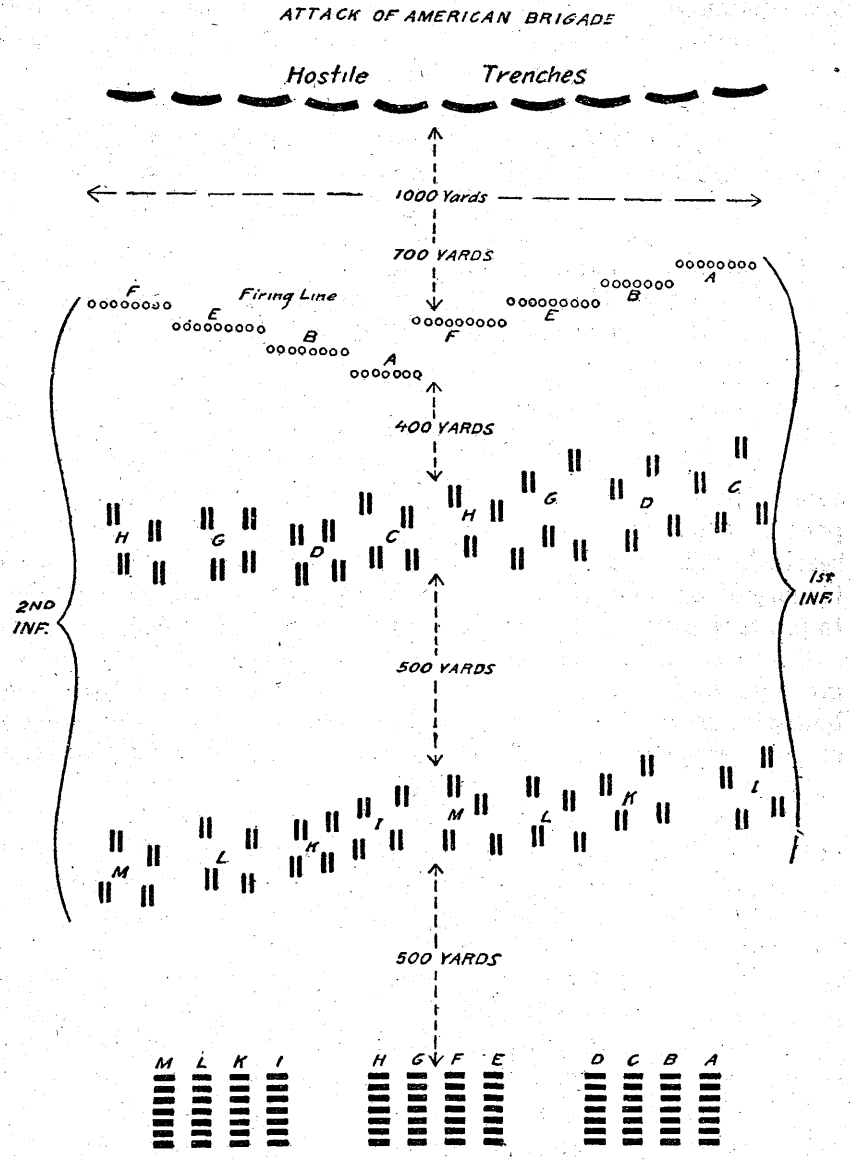


Fig No 8

men of all three brigades and of at least four regiments. In the formation of to-day we see that, except by two companies of the same battalion, there is no mixing of units until the assault, when mixing units does not greatly matter, since by that time the bayonet has

become the principal weapon. But mixing units during the advance from the first firing position to the assaulting position does greatly matter, because it breaks up arrangements for fire direction, control, and communication, and requires their reorganization just when to do so is most difficult. Yet to make any advance at all during this decisive stage of the fight requires the maximum development and efficiency of fire. We have learned a great deal about the meaning of distribution in depth since the Civil War, but perhaps our organization does not yet permit the best use of what we have learned.

TACTICS OF THE FUTURE.

Will our drill regulations require radical modification to conform to the experience of the great war? It seems to me the answer is, No. The formations contemplated and the principles taught in our drill regulations have been proven in the main correct.

In one respect, however, I believe our organization is faulty, since it does not permit us to carry the principle of formation in depth to its logical conclusion. Our companies should be large enough to support their own firing lines, i. e., to fight in two lines, and so postpone any mixing of organizations until the assaulting position is reached. This would require a company of 250 effectives, which is the size of the infantry company in every other country that pretends to military power. We shall ultimately come to the large company.

European nations have also armed their infantry with hand grenades, so that during the assault the enemy may be deluged with bombs of great power. Grenades have been issued to some, at least, of our regiments; and I presume grenadiers are being trained in their use.

The machine gun has shown itself of extraordinary efficiency both in the attack and in the defense, but as was anticipated, chiefly in the last named. In position warfare, such as that on the western front in Europe, about the only limit to the number of machine guns is the number that can be obtained. In mobile warfare, on the other hand, the number of guns with a regiment should not be so increased that their many animals and wagons hamper the regiment and detract from its mobility. In the United States, organization should be based on the requirements of mobile warfare. We should, therefore, decide upon the number of guns per regiment after learning what the Germans have found expedient in the mobile campaigns on the eastern front, rather than from their defense in the west. My opinion is that six light guns for one of our small regiments will be ample. But back of that the brigade commander should have a detachment of 12 heavier guns for a brigade reserve.

Our present gun is not a machine gun properly speaking, but an automatic rifle. It is still to heavy to give to the individual infantry-

man, but we can expect to be armed throughout with the automatic before many years.

Asphyxiating, incendiary, screening, and tear-compelling gases have all been found of military value, and we shall probably see their use in the future continued. In self-defense we must be prepared with the machinery and training necessary for their use, and equipment for defense against them.

The doctrine that superiority of fire must be obtained in order to advance has been proven correct by the experiences of the present war. That superiority is obtained by a combination of rifle, machine-gun, and artillery fire upon the decisive front, and even when close at hand by the addition of grenades thrown from guns or by hand. As was to be expected, against highly organized entrenchments and entanglements, the value of artillery fire relatively rises. In mobile warfare the rifle continues to be the main factor in obtaining superiority.

The German theorists before the war generally recognized that the more difficult the task assigned a unit in attack, the greater its depth must be in proportion to its front; that is, the greater the number of echelons behind the firing line, so that wave after wave could beat against the hostile position. The war has substantiated the truth of this belief.

Figure 9 is the picture of a German regiment attacking at Verdun in 1916. The leading battalion attacked on a front of two companies, or about 200 yards. The second and third battalions followed in second and third echelon. That is, the whole regiment of 3,000 men had a front of only 200 yards; it was attacking with 15 men to the yard.

As a necessary preliminary to the attack the German aeroplanes had photographed the French trenches for thousands of yards back of their front, and each company and higher commander carried a large scale map of the ground, over which they were to attack, with the enemy's trenches accurately platted thereon.

The two first line companies attacked in three lines, the first one being very thin, with perhaps 5 or 6 yards between men; the second and third lines shoulder to shoulder, and 30 to 50 yards apart. The thin first line determined whether the fire preparation by artillery and infantry had been sufficient; in particular, whether the French entanglements contained enough breaks to permit passage, and whether there were too many French machine guns still in action. When the fire preparation was deemed sufficient, the second and third lines promptly followed the first. All lines included grenadiers as well as riflemen. The third line also carried sand bags and additional tools for the prompt organization of the ground gained. The remaining companies of the leading battalion followed at once,

German Regiment at Verdun
1916

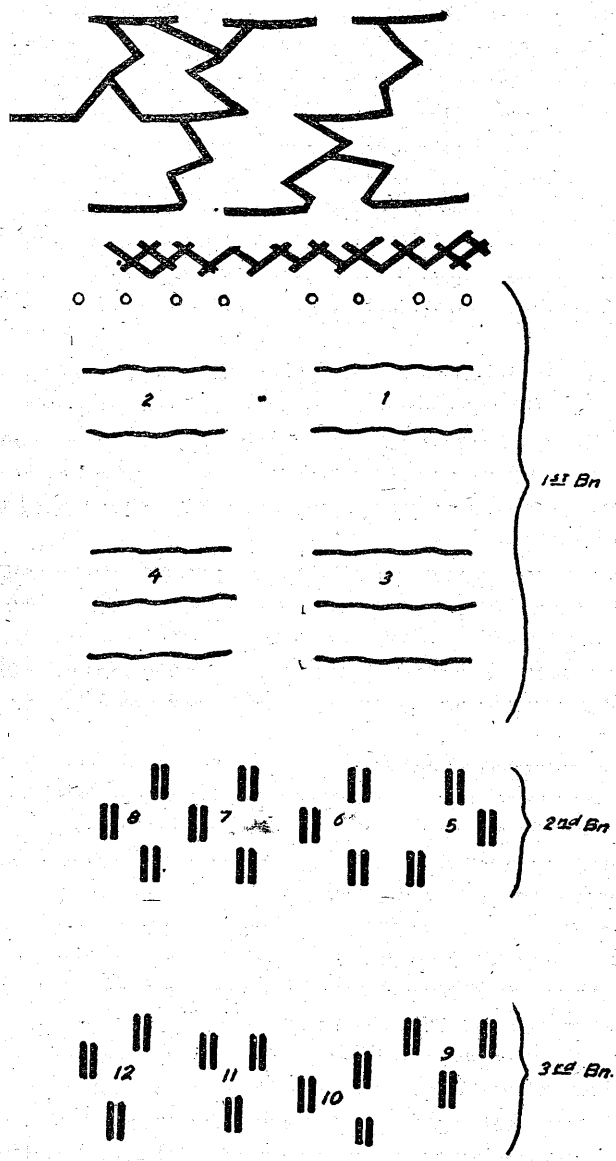


Fig. No 9

immediately fortified the captured trenches, and sent bombing parties to clean out the communicating and flank trenches. The second battalion passed over the first and attacked the enemy's second line; and if everything worked as planned, the third battalion passed on to the French third line trenches. If any battalion was defeated and destroyed in its attack, the following battalion abandoned its assigned objective and renewed the attack of its defeated predecessor. In this way wave after wave of men could, if necessary, be thrown at the hostile trenches on a front of only some 200 yards.

It must be remembered that this formation is suitable for the attack of a highly prepared system of fortifications, where not one but several lines of trenches had to be overrun and the whole consolidated and held under the inevitable counter attack.

It is difficult to imagine a duplication elsewhere of the present state of affairs in France. Both sides rest both flanks on impassable obstacles—the sea on one side, Switzerland on the other. Such practically stationary trench warfare can hardly take place in the United States, because similar enormous numbers will not be here engaged and the theater of operations will be relatively so large that flanks can usually be reached. Great care must therefore be exercised in making deductions from the experiences on the western front that we do not take as of general application formations that are simply expedient under these very special conditions.

MORALE.

It will be evident from the whole of the preceding discussion of formations for attack that all such are based largely upon human nature. The officer must remember always that the raw material of an army is moved by complex motives and emotions; that not only do these motives and emotions differ widely between individuals but that in the same individual they differ widely from day to day and even from hour to hour. Yet, if as a leader of men he is to obtain results, he must study this human material in the individual and in the gross and must acquire a judgment of, and a sympathy in, its hopes and fears that will enable him to know what can be demanded of the men and how to obtain the maximum in the way of performance.

Under fire all men are afraid. It is doubtful if there have ever been many pairs of legs that did not have to be dragged very unwillingly toward the enemy. The man we call a physical coward, and there are very few such to be found, is simply one whose nerves and will power are so weak that his unruly legs get beyond control. There is a breaking point for the collective nerves of any command; there comes a time, under the fearful scenes of battle, when the will of the organization is no longer able to drive its legs forward. By

discipline, that is, by training the moral qualities in order to raise the will power and pride both of the individual and in his organization, we seek to raise that breaking point; and then in action we adopt formations that strengthen the soldier's will and assist him to control his legs. To what great heights the discipline of troops may be brought is shown on the European fields to-day where large commands occasionally suffer practical annihilation before breaking.

Not only psychology but physiology as well enter into the problem. It is one thing to go into battle on a bright morning, in dry clothes, and with a full stomach; and it is an entirely different, and very much harder thing to do the same on a cold morning, in wet clothes, and without breakfast. In the latter case, the will of everyone has much more of a task to drive those legs forward.

Study of the moral factors that animate men is therefore of great importance in the education of all officers, but particularly of those who command infantrymen. Something can be learned from books; I advise you all, for example, to read Maj. Eltinge's Psychology of War. But the greater part of your study must be of the men you command. From association with them you must learn how best to appeal to their higher qualities, and to help them in controlling their baser emotions.

Because of their importance, all tactics must be based primarily upon the moral factors of the problems. Some leaders in the world's history have ignored these factors, but they have usually not had much success. The successful officer, whether he commands a platoon or an army, has constantly in view measures to raise the morale of his own troops and to depress that of his enemy.

From all of the foregoing, it is evident what extraordinary demands the modern battle makes upon the discipline, courage, and training of the infantry soldier. He has to advance without reply for thousands of yards under a deadly fire. Then he has to continue that advance for hundreds of yards farther under such circumstances that only by the display of the highest technique in the use of his own fire can ground be gained; and his fire must be made highly efficient with many of the factors that enter into his problem unknown or only to be guessed at. His judgment must remain cool and correct in all of the appalling conditions and circumstances of the battle field. But above all other factors, moral or physical, the infantryman must be imbued with the firm determination, no matter how many of his comrades are down, no matter how inevitable his own death may seem, so long as he can stand to continue his advance. This determination is the product only of the finest discipline, which itself is a habit of mind so firmly fixed by long training and service with the colors that the awful experiences of the modern battlefield can not destroy it.

All of the pomp and circumstance of war have gone from the battlefield of to-day, but its harshness, cruelty, and brutality are more than ever in evidence. So much the more glorious, therefore, is it in the infantry that endures and conquers.

This class, in the new Army of the United States, will for many years have a large part to play in training our men and fostering among them the high discipline necessary for meeting the veteran troops of Europe; and ultimately will help to lead our splendid men on the battlefields that sooner or later will inevitably confront us. Remember always that while character in the enlisted man is important, it is essential in the officer, who above all others, must hold his interests or his life of little value if their loss will promote the success of his comrades.

PART II

NOTES ON CAVALRY

LECTURE DELIVERED
FEBRUARY 14, 1917

By

MAJ. LEROY ELTINGE

NOTES ON CAVALRY.

The first use of the horse in battle was as a draft animal, harnessed to a chariot. At first, rich and influential men rode to the battle in a chariot, and then dismounted to fight, the chariot being turned about and held a few yards in their rear ready to receive them in case they lost their nerve and desired to flee.

Next the horses were shielded by armor, and the axles and neck yokes of the chariots were provided with short, sharp knives that enabled a fast-rushing chariot to mow down ranks of men as a lawn mower cuts the grass. Ensconced behind the protective body of the chariot, covered by a shield that the driver held for him, standing thus on a raised platform that gave increased range and accuracy to his arrows and provided with unlimited ammunition (i. e., arrows) borne in the body of the chariot, the fighting man in a chariot had little to fear from the dismounted enemy. The chariot was the artillery of the ancient battle field. This change in the tactical use of the horse required nearly 500 years for its accomplishment.

Meanwhile two of the main tactical uses of the horse were being conceived and tentatively used.

To search out the enemy and keep constant touch with him while he was still at some distance, the value of the rapid rate of progress of the horse (i. e., his mobility) was realized. Also the value of this same mobility in pursuing a defeated enemy began to be realized. At first both these operations were carried out by chariots. The warriors were transported in the chariots, but, having gained contact with the enemy, the physically fresh men left their vehicles and conducted their operations on foot, being followed by the chariots as our dismounted cavalry is followed by its led horses. Later they fought from the chariots whenever the ground permitted. However, these operations of reconnaissance and pursuit most frequently took them into such rough country that wheeled vehicles could not operate close to the enemy and still had to serve much as our led horses do. Finally some of the bolder spirits would unhitch the chariot horses and while the driver rode one horse and led one, the archer would ride the other one of the pair and use his bow and shield. These first real cavalrymen had no saddles. They rode draft horses equipped with a driving bridle, collar (or rather breast strap), traces, and breeching. The rider held on by the collar and rested his feet on the traces, that had been picked up and tied to the breeching. For centuries after true cavalry was used, these were

still the horse equipments. Finally the warrior learned to ride bare back and to control his own horse. The change from chariots to mounted horsemen was another 500 years in being fully accomplished.

Still shock action was not used. Reliance was on the fire action—that is, on arrows and javelins. The Thessalonians appear to have been the first to use shock action. They formed a wedge, point toward the front, and rode at speed into the infantry of their enemies, splitting the massed infantry formations into fragments and trampling down the fragments. From the Thessalonians Philip of Macedon and his son, Alexander the Great, learned the use of shock action. They abandoned the wedge formation and attacked in line several ranks deep. All of Alexander's victories were won by his cavalry. He also inaugurated the principle of the pursuit of a beaten enemy to the last gasp of man and horse. In one case he pursued the beaten Persians 70 miles in 36 hours. That principle is as good to-day as it was in the time of Alexander. A defeated army is totally helpless till it can reorganize. It is the business of the cavalry to keep it from having a chance to reorganize.

In the fortress warfare that is going on to-day along the whole line in France there is no use for cavalry, but the hope of driving the enemy from his trenches and thus have a chance to pursue him to his destruction leads both sides to hold cavalry close in rear of their intrenched lines.

From Alexander to and including Frederick the Great, most great captains used their infantry for a sort of holding attack and their cavalry to deal the decisive knockout blow. The simple notable exception is the Roman who had no genius for horsemanship and therefore made comparatively less use of horsemen.

The increase in range and power of modern firearms and an increased use of intrenchment and obstacles caused cavalry to change from the decisive to one of the auxilary arms. Since the time of Frederick the decision has been sought with the infantry, which has become the principal fighting arm of all nations. Infantry has great power and composes the bulk of all armies. It also has limitations which require that it have loyal and intelligent assistance in order to win battles.

Its two chief assistants are the cavalry and the artillery. The cavalry gives the greatest aid before the battle and after the battle. During the battle the cavalry also aids by protecting the flanks and preventing surprise. Likewise, by a threat at or attack on the hostile flanks and rear, it can weaken the hostile morale or staying power. Lacking sufficient infantry or needing quick reenforcement of a part of his line that infantry can not quickly reach, a commander will put his cavalry into the main battle line. This he does

only from necessity. To take cavalry from the important duties which it alone can perform and use it as infantry is to throw away the advantage of having cavalry. Only an ignorant chief would willingly do that. The man who uses his cavalry as infantry in his main attack may win the battle but he will not have cavalry ready to reap the benefits of victory. The enemy will soon re-form and reorganize and be ready for another battle.

If a defeated enemy be fiercely pursued by a successful cavalry, that army (as an army) will never fight another battle. Good examples of tireless and effective pursuit are Waterloo and Nashville, not to mention Appomattox.

Cavalry, like infantry, was originally formed in many ranks and for a similar reason. Only the first rank or two fought, but the moral value of the mass, both as giving confidence to the attacker and in looking impressive to the one attacked, was so great that the mass could win over a longer but less imposing thin line. As the range of projectile weapons became greater the reduction in the number of ranks of both cavalry and infantry came about. Finally, cavalry came to be universally formed in two ranks for mounted action. As early as 1800 some leaders advocated a still further reduction to one rank. This was on the theory that the second rank did not push the first forward, which is true. On the other hand, a single rank opens out, suffers losses, and soon is not a solid continuous line. It takes more than one rank to make the charge compact and give it sufficient rigidity for striking power. No country except our own has as yet adopted single-rank formation.

During the Civil War our cavalry had two sets of formations, some portions using single rank, others double. Just after the Civil War, the single rank formation was definitely adopted. Our new drill regulations still adhere to that formation as a general principle but have a means of changing to double rank at will. As a matter of personal opinion I will state that the single rank is best adapted to the needs of our Army and that it is likely to be adopted by other nations.

Under certain circumstances, particularly for a mounted charge the double rank is preferable, but our new drill regulations provide a way to use double rank when desirable.

The first great development of the use of cavalry dismounted to fight on foot was during our Civil War, though it had been in use for over 100 years in other armies. Other nations were slow to copy us, but all are coming to it now.

We were so proud of developing dismounted work for cavalry and making a success of it that it became a fetish with us so that we did not know when to stay on our horses just as other nations did not

know when to get off. I have seen a squadron of United States cavalry leave its road and abandon its mission to make a dismounted attack on a hill one-half mile to the flank of the route because a hostile infantry patrol appeared on that hill. Compare this with Gen. French's mounted attack at Klip Drift, and Capt. Bechtoldsheim's charge at Custozza, both of which I will relate to you later. Modern cavalry will do much work dismounted, but it will be successful only when it can make effective use of whichever method of fighting the situation calls for.

The present day uses of cavalry, except when in emergencies it is used as infantry, are five in number and all are of the greatest importance.

They are:

(*a*) Searching out and definitely locating an enemy and thereafter keeping constantly in touch with him so that he can never surprise your army by a move of which you have not ample warning.

(*b*) Covering the flanks and rear in battle and bringing pressure to bear on the hostile force by threatening or attacking his flanks and rear.

(*c*) Pursuit after a victory or covering the retreat after a defeat.

(*d*) Protecting the infantry and artillery in camp and on the march.

(*e*) Special missions at too great a distance for infantry to cover in the time available.

(*a*) I will now dwell upon these uses more in detail. When a campaign opens, be it large or small, the opposing forces are usually a considerable distance from each other. Often the actual location of the enemy will not be known. By means of a secret service and reconnaissance by airplanes the enemy's main force will be approximately located.

It then becomes necessary to locate it accurately and to "keep touch" with it so that it can make no unwatched move.

Now I will digress and explain to you just what is meant by keeping touch. For this purpose I will outline the Italian campaign in Abyssinia in 1896. The Italians had no cavalry. Equally the Abyssinians had none, but they had the equivalent for keeping touch in the form of runners who could cover ground at the speed of a horse.

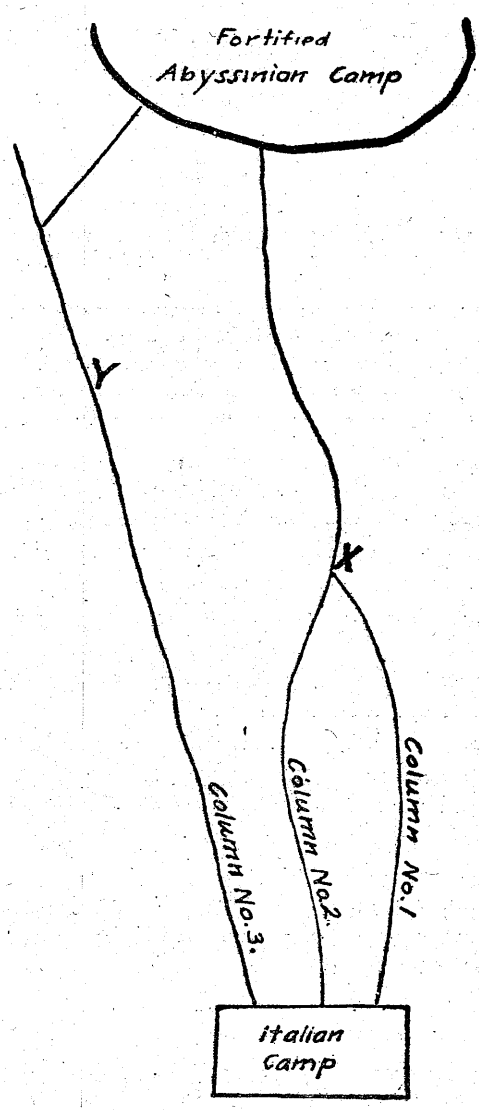
The Italians had information that the Abyssinian Army was about 16 miles away, intrenched and in superior force. They decided to make a night attack. It was understood that three routes led to the Abyssinian camp. (See Pl. I.)

Shortly after dark the Italians began their march, using all three roads. The Abyssinian runners saw the movement and promptly reported it to their chief while themselves falling back and constantly watching all three columns. Really the roads ran as shown.

About midnight column No. 2 had just started to pass X when column No. 1 came in on its flank. Neither expected the other and each took the other for the enemy. A fight in the darkness ensued.

Finally the columns discovered each other to be Italians and after considerable delay and confusion they resumed the march in one column. Meanwhile column No. 3 had marched to Y. The Abyssinian chief had not waited to be attacked. He had moved from camp with his whole force by route No. 3. As the Italians had no

PLATE I



cavalry they had no touch with the Abyssinians and did not know this. The same lack of cavalry had kept columns Nos. 1 and 2 from having advance parties far enough ahead of the column to have prevented the encounter at X being possible and to have kept touch between all three columns so that each constantly knew where the others were.

Now, column No. 3 was out of touch with the enemy and out of touch or sight or hearing of columns Nos. 1 and 2. Just here column No. 3 was fallen upon by the whole Abyssinian force and utterly destroyed. Besides the killed, over 4,000 Italians were captured and mutilated. The Italians did not have airplanes and if they had bicycles could not use them in rough country. Had they been provided with these accessories it would have made no difference, for all the Abyssinian movements took place at night. This case also illustrates the principle that a night attack must invariably be preceded by ample daylight reconnaissance of the hostile position and the routes leading to it.

Now, if you understand what "keeping touch" means, I will proceed.

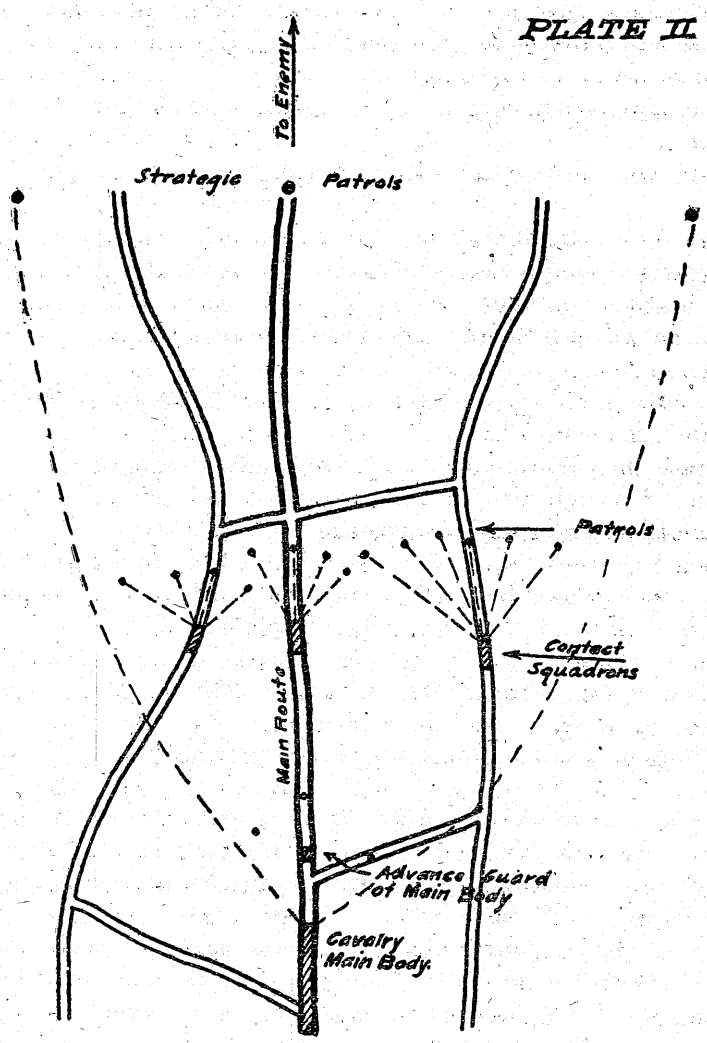
Having in a general way located the enemy's masses the army commander will send forward his cavalry to gain and maintain touch with the hostile main force. About where the enemy is now we know. Whether he will stand still, advance, or retreat we do not know; hence to avoid surprises a large front must be covered. For this purpose the bulk of the cavalry will be disposed as shown in Plate II. This is not a model formation to be blindly followed. It is a diagram to illustrate the general idea. In applying the principle to varying conditions of terrain and circumstances of ourselves and the enemy great variations will always be necessary.

The main cavalry body, in absence of special information that indicates other measures, will take the main route toward the enemy. Even before the march starts strategic patrols will be sent toward the enemy. These will be made up of selected officers, men, and horses, and, as they travel in small bodies, they can go much faster than a long column. They are not charged with the protection of their own main column but with gaining inportant information of the enemy. They do not waste men and horses by fighting when a fight can be avoided. They seek to avoid the advance parties of the enemy and penetrate between them or circle outside of them and look only for information of strategic value; that is, for information which will affect the main commander's general plans. To give you a general idea, not as fixing limits, strategic patrols may be from 10 to 100 miles from the main body. Having gained their information the next thing is to get it back to the commander. They may try to ride to a flank and use commercial telegraph lines, or to seize and drive a motorcycle or automobile through or around the enemy or to use wireless.

This latter is difficult and dangerous; for a pack mule carrying wireless can not go at as rapid a gait across country as the patrol will have to do; it takes time to call a wireless station and send a message which, in proximity of the enemy, you may not have; and

wireless transmission by pack sets is uncertain and open to the objection that the enemy may "listen in." Failing, other and more rapid means of certain transmission the patrol, or a part of it, may try to return with the message. The best of information is of no use unless transmitted in time to be of value, so a patrol must use every possible means to promptly transmit information gained.

PLATE II.



Usually it will attempt to use two or three means at the same time, so as to make transmission certain.

As the main cavalry force starts out it will deploy what is called a "screen." This screen will cover a considerable width of front. A cavalry brigade would cover a front of not less than 5 miles, perhaps much more. This screen consists, nearest the enemy, of patrols,

so distributed as to cover the whole front. Some 3 to 5 miles behind these patrols will be small formed bodies called "contact troops," or "contact squadrons." Really two of our war strength troops form a suitable force for contact work. Behind the contact squadrons at a variable distance of, say, 2 to 15 miles, the main body follows by the main route and easy stages. As long as no enemy is encountered the main body will wait at one strongly defensible locality till information that it can make a half day's march or a whole day's march in security is received from its advance parties. It marches with advance guard and flank patrols like any other column but marches in security and with little fatigue. Its marches are usually not long, say, 15 to 25 miles, as it does not desire to get too far away from the army it is covering, nor can its patrols and small parties do effective work if the main body overruns them. With a cavalry division marching 25 miles a day most of the horses of the contact squadrons will have to make 50 to 75 miles a day, for the patrols cover much more distance than the squadrons and hence have to be relieved frequently, while messengers are constantly passing between the different parts of the screen and, further, use up horseflesh. At times it will be necessary to march faster, which means with less protection, as patrols, to be effective, must have time to do their work and transmit the information gained. Where the roads are good, motorcycles should be attached to main cavalry headquarters and to the contact squadrons for the purpose of quick communication. They can not be used in advance of the contact squadrons. For the same reasons that wireless is seldom useful with strategic patrols, its employment by contact squadrons for transmission of information back is not frequently resorted to. Under field conditions you can usually send a message over a distance of 4 to 5 miles more quickly by mounted messenger than by wireless.

As your cavalry advances it will encounter hostile cavalry with a mission similar to its own. First patrols come in contact. Here you do not want the hostile patrols to get through and find out what you have in rear. These patrols, furthermore, will have the first engagements of the war. You can not afford to let the enemy's forces run over you here and gain the idea that his fighting qualities are superior to yours. Fierce and aggressive fighting is called for on this first contact. Some patrols should try to work by stealth, while others have a mission that requires them to work by force. Here is a case where you need to use force.

One of these patrols that encounters a hostile party that is too strong for it may keep in touch with it, follow its movements, and send to the contact squadron for help. The commander of the contact squadron receives information of all that is encountered over a front of several miles. He will send support or take the whole

squadron to the point most needing force. The object is to break through the hostile screen while preventing the enemy from penetrating behind our screen. This consideration brings on small cavalry fights. Eventually these squadrons encounter superior strength, because the contact squadrons are supported from the main body as the patrols have been supported from the contact squadrons. This brings on a general cavalry engagement in which each side strives to decisively defeat the other. If your side is successful you drive the hostile cavalry back on its main force and keep it there. Thereafter you have a wide territory in which your army may maneuver free from observation while the enemy is able to learn only what happens in his own immediate vicinity. All the hostile actions are known to your commander while the hostile commander can get only such meager and uncertain information of your force as can be learned by airplanes or through spies. Your commander can make a plan and carry it out. The hostile commander can have no definite plan, as he does not know what conditions he will encounter from hour to hour.

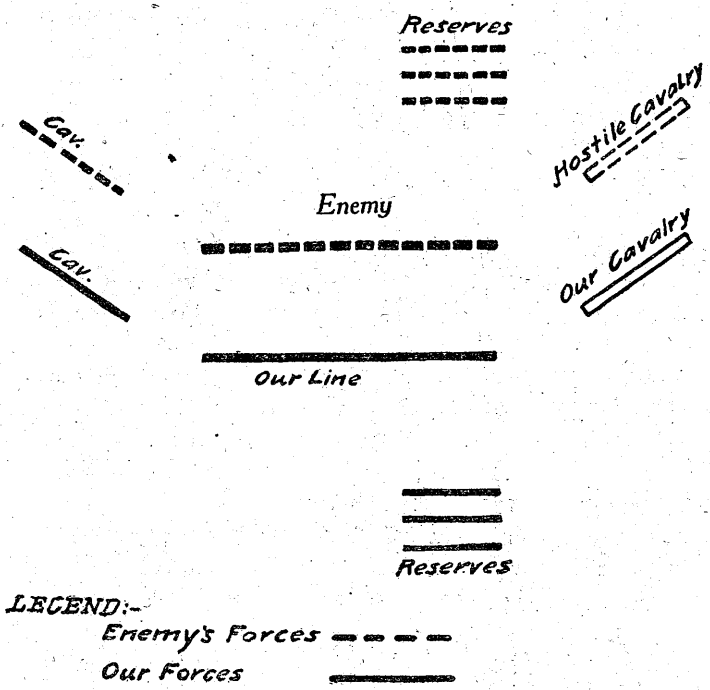
(*b*) Eventually the two armies closely approach each other. As they come within artillery range of each other the space between them is too limited for the effective employment of cavalry. Distances are now so small that infantry has sufficient mobility for the work and, being unhampered by led horses, can do it more effectively. Knowing this condition was about to occur the cavalry commander has gradually drawn his force to the flanks where it can work effectively. The information most wanted now is where the enemy is massing his reserves, which will indicate his plan of battle. In clear weather and during the daytime airplanes can obtain this information and can return with it much more quickly than can cavalry patrols. On the other hand cavalry can be on the ground and on the job day and night, clear or foggy weather, and can explore wooded areas where aircraft can see nothing. It can be assisted but not replaced by aircraft.

If your army commander decides to attack he will usually, but not invariably, want the bulk of his cavalry to operate on the flank and, at first, the front of his main attack. If he decides to act defensively he will usually want the bulk of his cavalry to operate on that flank where the hostile attack would be most dangerous. In either case a fraction of the cavalry will be sent to the other flank to prevent surprises.

Just before the battle and during the battle our cavalry will seek a relative position to the enemy as roughly diagrammed in Plate III. This is only a diagram. In an actual battle the nature of the country or the commander's plan of action may change it entirely.

But to take up the diagram, notice how much room our reserves have in which to move. Under favorable circumstances they can move free of observation. Even if the movement is observed by aircraft the enemy can do nothing to prevent or delay it till he has dislodged our cavalry, which will take time, during which the reserves move in security and without hindrance. The diagram illustrates clearly enough how just the reverse applies to the enemy. Now, if our cavalry gained the ascendancy in the cavalry battle that took place before the armies themselves actually met, it can probably attain this favorable location, though it will have to fight for it.

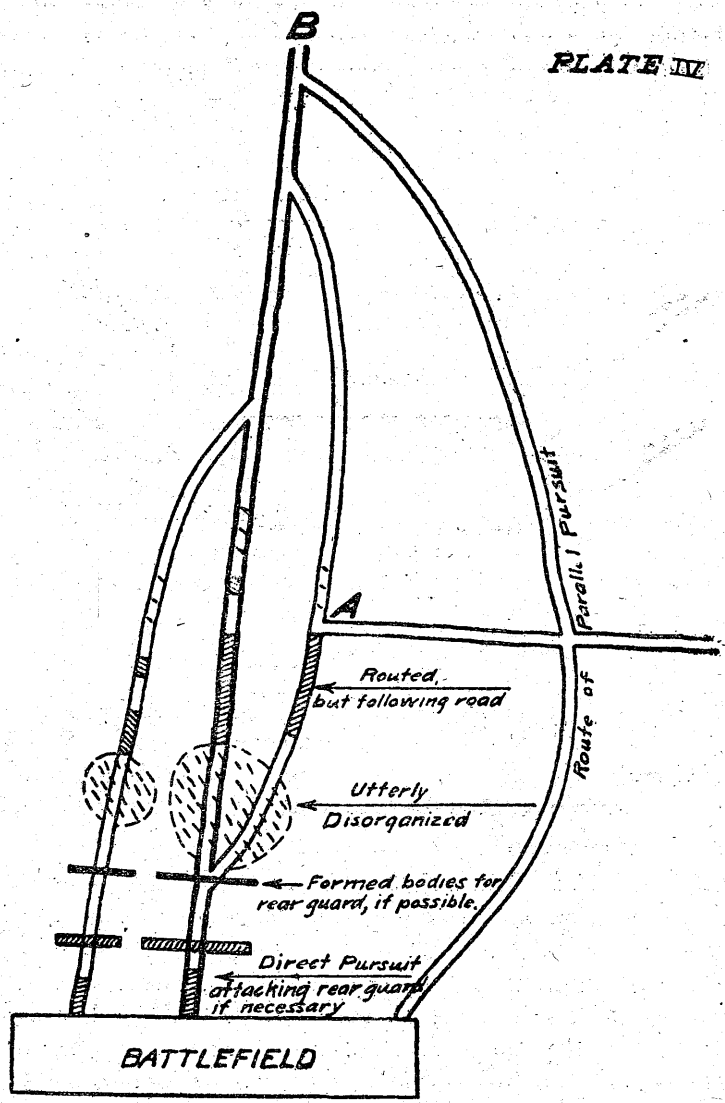
PLATE III



The enemy may detach infantry to support his cavalry and thus help to keep you from gaining this favorable location. At any rate it is your ideal location and you should be willing to fight for it.

(*c*) The battle may be a draw or may result in either a defeat or a victory. Should it be a defeat your cavalry (Pl. III) will attack the flank of the pursuing enemy and delay and annoy him till your own army can shake itself free and form a regular rear guard. Should it be a victory, your cavalry will be in position to do the enemy the greatest possible damage on the actual field of battle or, according to circumstances, to begin a parallel pursuit and perhaps force the surrender of the whole hostile force.

By a parallel pursuit is meant (see Diagram IV) one that does not follow directly on the heels of the enemy but goes to one of the flanks of his route and by superior speed attains (A) a position from which an attack may be launched against a flank of the retreating column or (B) a position, usually at a defile, which you can hold temporarily against any attack the disorganized hostile forces can make. In the latter case the capture of the hostile army is certain unless fresh hos-



tile forces can be brought up from the rear to dislodge you. Both these ideas were illustrated by Sheridan's cavalry in the Appomattox campaign. First, the attacks on the flank delayed and further dis-

organized the enemy and eventually the position across the line of retreat forced a surrender. In either case the parallel pursuit must be combined with a direct pursuit. The latter may be carried out by the infantry and heavier field artillery assisted by cavalry. This cavalry comes from elsewhere than the main cavalry force, as I will explain under (*d*).

A parallel pursuit by infantry could not usually make sufficient speed to cover the additional distance in time to be effective.

On good roads the cavalry can be assisted in a parallel pursuit by infantry in motor vehicles. These vehicles are easily delayed to the speed of marching infantry by an insignificant force of hostile cavalry that obstructs the road and fires on the head of the column. If your cavalry is not strong enough to do its work alone you may support it by infantry in motor or other vehicles but it can not be replaced by infantry carried by any kind of transportation. Motor vehicles work well only on good roads out of the immediate presence of the enemy.

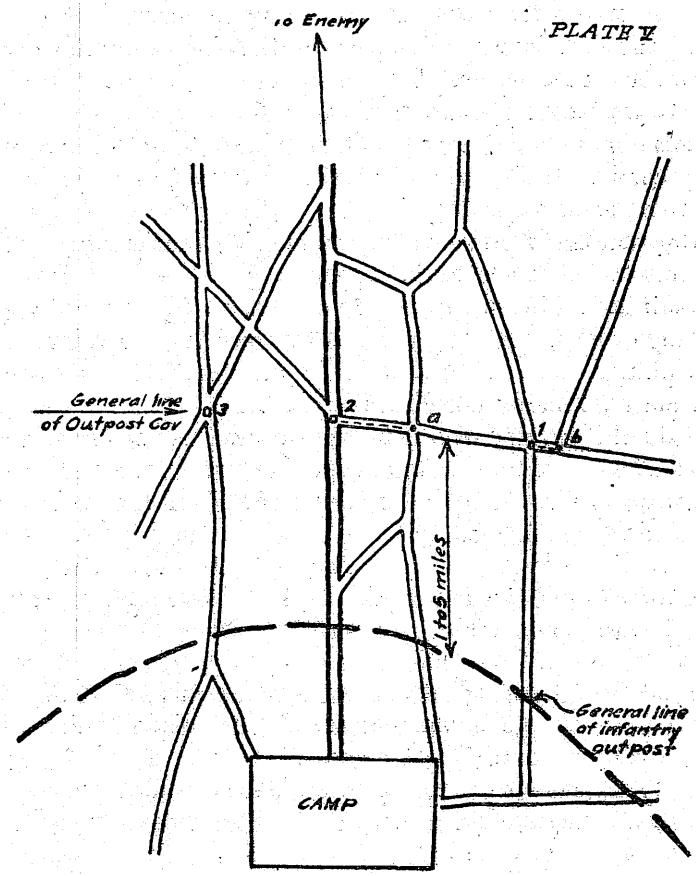
Greater damage is done the enemy by disorganizing his force than by the number of killed and wounded that he loses. Every effort of the pursuit is to keep up this disorganization. Do not stop your pursuit at nightfall and let the enemy have a chance to reorganize. A cavalry platoon charging through a disorganized division in the dark will do more damage than would be caused by the instant death of a thousand of the hostile soldiers. In the dark the disorganized crowd will see hostile cavalry everywhere and will either mill around in hopeless confusion till daylight, when it will be too exhausted to continue the retreat, or it will rush off in hopeless confusion in the dark, and run its legs off in the hopeless attempt to escape the image that has been forced on the crowded mind. Night is the greatest opportunity for bold cavalry pursuit.

(*d*) So far I have spoken only of the main cavalry body, which with an army is a cavalry division or cavalry divisions. This is the army cavalry and is accompanied by horse or light artillery and by the usual division trains. The main principles, however, apply to cavalry in any strength attached to a separate infantry force through variations in method and, especially in distances, will be made for smaller forces.

Reverting to an army, you will remember that a regiment of cavalry is part of the organization of each infantry division. This is called "divisional cavalry" and is used for the immediate protection and assistance of its own division.

In camp it does not relieve the infantry from doing the outpost duty but is used really as a second outpost beyond the infantry outpost. These cavalry outposts are stationed along all routes by which a large formed body of the enemy might march. (See Pl. V.) While the infantry outpost must never relax its vigilance, you can see that

its work is very much easier and the whole camp is much safer if outpost cavalry is some distance in front of the infantry outpost and watches all routes by which the enemy might advance. The divisional cavalry furnishes the detail for the outpost cavalry, which is under the command of the outpost commander and reports to him. These parties of outpost cavalry are shown in the roads by the plate. Actually they conceal themselves near the point they are watching, in a position so located that they can fight and defeat a small hostile party that comes that way, but can easily retreat from and escape a



large hostile force. In the latter case they would keep just out of reach of the hostile force but continue observation of its movements and keep the commander constantly informed as to where the enemy was and what he was doing. In addition, the division commander will usually send out two or three patrols that act somewhat as the strategic patrols did in the illustration shown in Plate II. They seek by stealth to so locate themselves that they can watch the main hostile force or the routes by which it must move in force, and to be able to

detect and report any large movement of the enemy either by day or night. This is one of the most dangerous and most interesting duties that fall to the cavalry lieutenant.

On the march the divisional cavalry acts in a manner somewhat similar to what it does in camp. If the division is operating alone the divisional cavalry has duties analogous to those of the army cavalry for an army, either during a march or during and after a battle. When the division is part of an army that has army cavalry (i. e., a cavalry division) the divisional cavalry protects its own division. It marches some miles, say from 2 to 10 miles, in front of the advance guard of the division, and also has detachments on the division's flanks and with its trains. This cavalry keeps constantly in touch with the army cavalry and with all adjoining columns. By this means the division commander is kept informed not only of what is taking place in his own vicinity but also of what is going on in all the friendly forces adjoining him.

In battle the divisional cavalry of a division that is part of an army will usually be held far enough in rear to be out of great danger from hostile artillery. If its division succeeds, it will, without waiting for orders, promptly attack the disorganized hostile fragments and complete their ruin. It will usually constitute the cavalry part of the force that makes the direct pursuit. (Pl. IV.)

Similarly the cavalry of a defeated division will strive to ward off attack on the disordered parts of its own division and with a part of the artillery will constitute the rear element of the rear guard as soon as one can be formed.

The divisional cavalry will also furnish a detail for the battlefield police. These men are the guides of the battlefield, especially intended to be able to direct ammunition, troops or officers to any desired place at the front, and wounded to appropriate places in the rear. They also arrest all stragglers and return them to the battlefield and take charge of small numbers of prisoners for which a specially detailed guard is not necessary.

(*e*) Many times it is desirable to strike a sudden blow at a distant fraction of the hostile forces or to destroy the hostile resources at a distant location. Raids are one form of these efforts. Such efforts of our own, or an attempt to meet and defeat similar ones of the enemy, constitute special missions for the cavalry. Infantry in vehicles, motor or other, may strengthen the cavalry for such work but can not replace it.

The supreme commander must take great care not to have his cavalry away on such a side issue when a battle occurs, for just before a battle and during its progress the presence of the cavalry is essential. Many an army has owed its defeat to the absence of the cavalry on a special mission when the decisive battle was fought.

There were several examples during the Civil War, of which, for one, Gettysburg may be studied.

MODES OF FIGHTING.

The question is frequently asked whether cavalry can attack mounted at all in face of the fire of modern firearms, and whether mounted infantry that used the horse for transportation but fought on foot would not do as well.

For a large force that makes up the decisive striking power of an army, as cavalry did in former days, the mounted charge is past. For medium sized forces, and small forces on occasion, a combination of mounted and dismounted work may, and frequently will, be used.

The force that dismounts to fight in the presence of modern artillery and machine guns must keep its led horses far back, certainly not less than a mile to the rear. Here comes the danger in medium sized forces. If your enemy can induce you to leave your horses that far to the rear while he has still the bulk of his force mounted, he has a good chance to capture your horses and leave you helpless for cavalry purposes. Or the enemy can maneuver so quickly mounted that he can then go into action, either mounted or dismounted, in such a location that he can bring his whole force to bear on separate fractions of your force one at a time. The smaller the force the greater this danger becomes, so our Cavalry Drill Regulations lay it down as a principle that smaller cavalry bodies should dismount to fight on foot only when the armament of the enemy and the configuration of the ground make it possible to keep the led horses close at hand.

In the work of the cavalry screen, in the pursuit and on sudden unexpected contact with any force, mounted work is quicker, safer and more effective than dismounted work. At night modern firearms are no more effective than antique ones. Equally when you catch a hostile force dismounted that, because of disorganization or of being already engaged on another front or of being in poor formation, can not turn an effective fire against you, charge them mounted. I will give you an example to show just what I mean. During the battle of Custozza in June, 1866, the Italians attempted to make a turning movement around the Austrian flank by sending two brigades and some artillery (about 10,000 men in all) by a road through the woods. This Italian force was not preceded by cavalry. While in the woods they encountered Capt. Bechtoldsheim of the Austrian cavalry leading a squadron of 104 men and 2 other officers. The encounter was unexpected to both sides. Capt. Bechtoldsheim signaled "charge" and in column of fours dashed at the advance guard. In the course of about 30 minutes he rode through the entire Italian force and back, emerging with 17 men, himself riding the horse of an Italian major that had been killed in the combat. Two Italian generals were wounded and the entire column routed.

As far as that battle was concerned the Italian loss was 10,000 infantry and artillery, for the force was utterly disorganized and could not be reformed till the battle was over. Under these circumstances the arms the Italians carried were just as effective as any modern arms would have been. In fact some of the Italian loss was caused by their own fire and longer range and more powerful weapons would only have added to this loss without causing any more loss to the Austrians. There have been many similar examples of the charging of infantry when caught so it could not deploy that have taken place both before and since Custozza.

We watch rifle fire at target practice and figure out how it would be impossible for a mounted charge to live under the fire of modern arms. In battle conditions are different. One who fires does not know the exact range nor does the target stay still; one may not have favorable conditions for firing; one will have no time nor thought for making adjustments for wind, light or temperature; and, above all, one is excited and unable to hold his piece steadily. As a general average an army expends 2,000 rifle cartridges or 80 shrapnel for every hit made on a hostile soldier, and only one-fifth of the hits cause death.

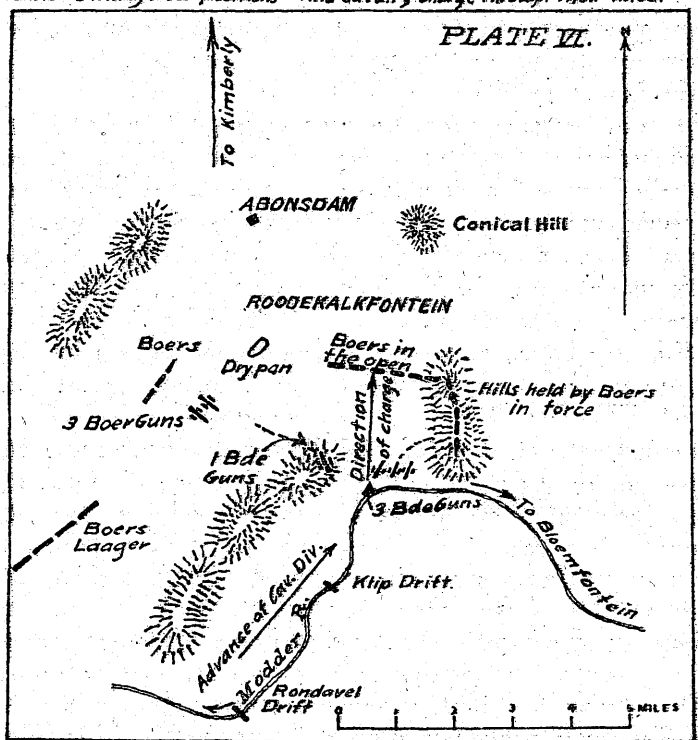
A swiftly moving horse is a poor target. When you get the fear of rifle fire on your nerves read of Gen. French's charge at Klip Drift. (Pl. VI.) Gen. Roberts while advancing directly on Kimberley sent Gen. French with a cavalry division by another route to go to the relief of the besieged garrison of that place. Gen. Roberts hoped to keep the Boers engaged on his front and thus enable the cavalry column to relieve Kimberley quickly, which he himself could not do, with the Boers in his front fighting delaying actions at every favorable location. The Boers discovered French's movement and sent a force to Klip Drift, a ford of the Modder River, to oppose him. French had reached this place by a forced march. He could not hope to attain his object by a long turning movement which would probably result in the Boers again appearing in front of him just as they had done at Klip Drift. He could not afford the time for forcing back this delaying force of Boers step by step over the distance of some 25 miles that separated him from Kimberley, also there was no water between the Modder River and that place. A diversion was made against Rondavel Drift and then Klip Drift was forced. The division's artillery and baggage was far behind; it was late in the day, and Klip Drift could not be again abandoned to the Boers, so French bivouacked for the night. During the night infantry came up and made the possession of Klip Drift secure, even after French left there.

The next morning the command moved out toward Bloemfontein to fool the Boers, but the head of the column soon came under fire

of the Boers on the hill directly south of Conical Hill. The horse artillery came into position as shown and opened fire. The Boer artillery replied and the British lost an officer and 12 men during this artillery fight. French now changed direction toward Kimberley and charged, mounted, straight at the main Boer line. The charge was enfiladed by the Boer riflemen on the hill to the British right at a range of 1,200 yards and by the Boer artillery to the left within easy artillery range and of course encountered a fire from the front.

GENERAL FRENCH'S DASH ON KIMBERLY Feb.15,1900

Sketch showing Boer positions And cavalry charge through their lines.



Taken from; With Gen. French in South Africa. (Goldmann)

Gordon's brigade led and charged as foragers in two lines, followed at 800 yards by Gen. French with the rest of the division.

The charge was successful, the Boers were routed, and the division reassembled at Abonsdam to learn that their loss in the charge itself had been four men wounded and two horses killed. This in the face of the famous Boer marksmen armed with modern high-power Mauser rifles.

When you come suddenly under hostile fire either charge or run, don't try to dismount; and remember that, if you run, the enemy will have confidence and will shoot more cooly and accurately than if you charge.

If you charge you may find that the enemy has ensconced himself among obstacles, natural or artificial, that a horse can not negotiate and you will come a cropper, nevertheless you must do something and do it resolutely. Under these circumstances you will suffer more if you hesitate than you will if you make a wrong decision but act resolutely.

Many times the terrain will permit you to dismount part of your force, even a comparatively small one, to use fire action while the remainder charges mounted. Foreign cavalry, much of it, has a machine gun or two attached to each squadron—the foreign squadron is between our troop and squadron in size but it is commanded by a captain and corresponds more nearly to our war strength troop than to our squadron.

Cavalry that has such machine guns attached to a squadron contemplates using them for fire action while the squadron acts mounted. They aid the mounted action and, in case of defeat, may check the hostile pursuit and serve as a rallying point for the squadron. On the other hand, if they are captured the loss is small, hence it is felt that the risk may be afforded. For this purpose machine guns must be light, capable of being handled by one man and of being carried on a horse that can be led at the speed and over the obstacles that the squadron may take. Another led horse carries additional ammunition.

The combination of mounted and dismounted action will be very frequent in forces of all sizes and will be the usual form of action of forces of a regiment or any mounted force of greater strength than a regiment.

As a general rule for your guidance you may take this: Stay on your horses and utilize your mobility as long as you can. Dismount to fight on foot when you have to do so or can gain an advantage thereby.

For the dismounted fight, cavalry is formed in several lines and fights in a manner similar to that of infantry. There is this main difference, that cavalry is not, or should not, be called upon for the long gruelling almost stationary actions that come to infantry. In cavalry actions time is usually a factor. A result must not only be achieved but it must be achieved quickly. From this, it follows that dismounted cavalry will want to develop its fire power more fully and quickly than infanrty does and that therefore it will have, proportionately, a greater strength in its first line and comparatively weaker lines in the rear. That is, it will employ less depth of formation and will have to rush its battle to a quicker decision. If employed to replace infantry for real infantry work, cavalry should employ infantry tactics.

Such reliable reports as we can get of the war in Europe indicate that American cavalry methods are in the main right. Some details will have to be changed. For example European experience shows that a body of led horses "linked" in our manner is not only clumsy, but dangerous, if it chances to get under long range artillery fire.

Accordingly our new regulations have Number Three the horse holder and have him lead the remaining horses by the reins. Then if one horse goes down he can turn it loose from the rest and proceed. If securely linked, when one horse goes down the whole four is anchored and makes such an obstacle that the whole column may be stopped.

Another idea that our new regulations has gained from the European experience of the present war is that led horses must be kept very far to the rear if artillery fire is to be expected. This led to the enunciation of the principle that small forces must not dismount to fight on foot unless ample cover for horses is close at hand, for otherwise they will either lose their horses or be so separated from them that all advantage of the mobility of cavalry is lost.

This talk is not very technical and in some cases not even technically accurate. By it I am seeking to outline to you what your future tactical study should elaborate and teach you to apply. One can not even outline the work of cavalry fully in the time allowed for this lecture. Those of you that are not in the cavalry need to know how cavalry is used and what it is trying to do for you.

Those of you that are in the cavalry will find that I have indicated to you the lines along which you should seek tactical knowledge. It will take you a lifetime to fully acquire that knowledge. While you are in the lower grades greater general knowledge is demanded of you than of those of similar grades in other branches, for you seek information for the supreme commander and must know enough to view a situation from that commander's standpoint, so that you will be able to understand what information he needs and get it for him; that is, when you learn the situation of a part of the hostile force you must know what bearing what you have learned has on the general situation and how important it may prove in determining your commander's plans. During and after a battle you must be able to tell what has happened and, often without orders, you must throw in your whole force to help out the general plan.

Your position calls for energy, determination, quick decisions, and self-reliance. You must know your job and have the physical and mental qualities to execute it. If this lecture has outlined to you just what to seek for in trying to make yourself a qualified cavalryman, it is all that I have hoped to accomplish.

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PART III

NOTES ON FIELD ARTILLERY

LECTURE DELIVERED
MARCH 5, 1917

By

CAPT. A. B. WARFIELD
Q. M. C. (FIELD ARTILLERY)

CONTENTS.

NOTES ON FIELD ARTILLERY:

PART I. Its ancient history and development from the Middle Ages and the Napoleonic era down to the present time.
PART II. The progress of modern artillery.
PART III. Modern artillery in the field.

INTRODUCTION.

In these notes I will endeavor to cover lightly the following points:

PART I.

A short historical review of field artillery, from the earliest time to the period of the beginning of the European war.

This will readily fall into the following subheads:

Field artillery of the ancients.

Introduction of gunpowder and its application to propelling missiles from guns too heavy to be carried by the individual soldier.

Field artillery from the fifteenth century to and including the Balkan wars of 1912–13.

Field artillery in the European war.

PART II.

A short talk on modern field artillery in general.

PART III.

Employment of field artillery in the field.

PART IV.

Lantern slides, illustrating the progress of field artillery.

NOTES ON FIELD ARTILLERY.

PART I.

FIELD ARTILLERY OF THE ANCIENTS.

Artillery, as the term is now understood, is the direct result of the invention of gunpowder. Previous to that time artillery consisted of machines for throwing heavy missiles to a distance by the release of a weight or spring.

The best known of these were the ballista and the catapult; the first throwing a stone and the last shooting out an arrow or similar missile. There were many different types of these ancient machines; some are said to have been capable of throwing a projectile of 700 pounds a distance of more than 1,000 yards. In some cases these machines were a crude sort of field artillery, though their lack of mobility prevented their being put to general use on the battle field.

INTRODUCTION OF GUNPOWDER.

Gunpowder has been known in China and India far beyond the earliest investigation. There are many ancient Chinese and Indian words signifying weapons of fire, heaven's thunder, and similar expressions. The Hindus of the time of Moses are thought to have had knowledge of the compound. Gunpowder was introduced into Europe following the Mohammedan invasion (1475).

The first authentic knowledge of artillery, firing projectiles from guns, in which the propelling charge was gunpowder, was at the siege of Toulouse in 1218. The Germans claim to have been the first to invent gunpowder through the experiments of one Schwartz, a monk, who announced his discovery in 1320.

The first guns were small; usually they were ironbound and shot arrows weighing about one-half pound, propelled by a powder charge of about one-third of an ounce. The cannon used by the British at Rouen in 1388 were of this description. The powder charge was exploded by ignition through a touchhole. In range and accuracy they were so insignificant that for two centuries they were overcome by the old missile engines, and were as dangerous to friend as to foe. The early users of cannon thought their chief advantage was the terror and confusion produced by their noise.

As early as 1453 the Turks employed brass cannon of enormous size which were used without carriages, being rolled along with handspikes and fired from the ground. The most famous of these early

guns was the great gun of Mahomet II, the bore of which was "twelve palms" and which fired a stone ball weighing above 600 pounds, and required for its transportation 200 men and 60 oxen.

The first attempts to produce rapid-fire guns were in the shape of making several small guns and uniting them on the same carriage. Sometimes they were mounted like the spokes of a wheel, the breech ends to the center.

In 1460 King James of Scotland was killed by the bursting of a gun whose test he was watching.

These guns were all muzzle-loaders and in many cases were made where they were to be used and then broken up, as it was impossible to move them. It was rare that these cannon were fired more than once during a battle, a rate of fire that certainly would not be considered sufficient in these days of 15 to 20 rounds per minute.

It was in Italy and Germany that cannon making was first introduced as a business and developed along progressive lines. It was from these countries that France obtained her first guns, that allowed her to hold the advantage over England. England, however, with that determination which has always been such a national characteristic, during 1515 to 1522 acquired many guns, and at the latter date Henry VIII was reported to have "enough cannon to conquer hell." In 1515 he had some 400 cannon, the most of them mounted on wheels.

In 1551, under Francis I, the artillery of the French consisted of six pieces and as they included the leading styles of the period, I will describe them in full.

The "cannon" were 9 feet, 10 inches in length; weight, 5,300 pounds; used a round ball of 33¼ pounds weight; was mounted on a wheeled carriage, and had 21 horses hitched in "tandem."

The "great culverin" was 10 feet long; weight, 4,000 pounds; projectile of 15 pounds 2 ounces, and was drawn by 17 horses.

The "bastard culverin" was 9 feet long; weight, 2,500 pounds; fired a projectile weighing 7 pounds 2 ounces, and was drawn by 11 horses.

The "small culverin" weighed 1,200 pounds, and fired a projectile of 2 pounds.

The "falcon" weighed 700 pounds; fired a projectile weighing 1 pound 10 ounces, and the "falconet," which was 6 feet 4 inches long, weighed 410 pounds, and fired a 14-ounce ball.

These cannon were of bronze alloy, formed by mixing nine parts of copper to one part of tin.

The British at the time of Elizabeth and James I had cannon with bores from 8½ inches down to 1 inch, some 16 different calibers; the weights of guns ran from 8,000 pounds down to 300 pounds, with

projectiles weighing from 66 pounds down to one-half pound; powder charge from 30 pounds down to three-fourths of a pound.

Mortars were first used at the siege of Cherbourg in 1418; at La Fere in 1580, and at Gibraltar in 1782. They were muzzle-loaders and were fired with a red-hot iron heated on the field.

Explosive bombs and hand grenades appear to have been first used by the Germans in 1580; at the present time, 1917, they are still making very effective use of them, with the added and more modern form of bombs filled with asphyxiating gases.

It is interesting to note at this time that many of the early guns were breech-loaders, in which the powder was loaded into a separate breech box and wedged up to the cannon. The intercepted screw was first used about this same time (the latter part of the sixteenth century). Early in the seventeenth century, when cannon of greater strength was used and grained gunpowder came first into use, it was found impossible to keep the gases of explosion from escaping about the breech and the muzzle-loading cannon superseded all other methods. The breech-loading guns have only within the past 25 years again come into general use and the muzzle-loader gone, it is to be hoped, forever.

FIELD ARTILLERY FROM THE FIFTEENTH CENTURY AND INCLUDING THE BALKAN WARS OF 1912-13.

What is probably the first important action in which field artillery played a decisive rôle, was fought at Melagnano, near Milan, Italy, on September 13–14, 1515. The French artillery, consisting of 70 large and 300 small cannon, was posted to sweep a causeway over which the Swiss infantry, composed of the best troops of Europe, had to advance. Several desperate charges were repulsed, mainly by the fire of the guns, the battle resulting in a victory for the French.

At Pavia (Lombardy, Italy), February 24, 1525, the French artillery had thrown the German Emperor's troops into confusion, when Francis I, Emperor of the French, ordered an ill-timed attack, masked the fire of his artillery, and lost the battle.

In the war between the Catholics and Protestants in France (1585–1594), Henry IV showed not a little skill in the use of his artillery, massing his guns on the flanks of his line, thus enfilading the enemy.

THIRTY YEARS' WAR.

The strength of artillery generally adopted at this time was in the proportion of one gun per 1,000 infantry. During the Thirty Years' War (1619–1649) Gustavus Adolphus of Sweden illustrated the best features of artillery organization and tactics. Recognizing that mobility was one of the greatest elements of power in artillery, he created an artillery that could not only fire quickly but could ac-

company the other troops on the march and change position in battle. His guns fired both solid shot and canister; his army had a proportion of six guns to 1,000 infantry.

WARS OF LOUIS XIV.

During the wars of Louis XIV (1667–1714) great improvements were made in the French artillery; guns were cast from both bronze and iron; the calibers were made uniform from 4 to 36 pounders; the powder charge was for the first time put up in canvas bags; grape-shot was introduced; howitzers and mortars came into general use; explosive projectiles began to be used by field artillery. The first permanent regiment of artillery was organized by the Emperor, who also established the first schools for instruction of officers in the science of gunnery.

WARS OF THE SPANISH SUCCESSION.

In the Wars of the Spanish Succession (1704–1708) the guns of the artillery were used with a degree of skill and effect never before known. In the battle of Blenheim (Aug. 13, 1704) a battery on the right of the allies enfiladed the French and contributed materially to Marlborough's victory.

WARS OF FREDERICK THE GREAT.

In the wars of Frederick the Great (1740–1779) the artillery was united into batteries and brigades, but was drawn by the animals only to the vicinity of the battle field, where the guns were handled by the men.

Frederick treated his artillery with contempt until a realization of its value was forced upon him by his own experience.

In the two greatest of Frederick's battles the artillery performed great service. At Rossback (Nov. 5, 1757) 18 guns posted as a battery wrought great havoc in the ranks of the allies; just a month later, at Leuthen, the Prussian guns, turned on the angle formed by the Austrians as they changed front to meet Frederick's attack, contributed greatly to the victory.

At Hochkirch (Oct. 14, 1758) the Prussian guns saved the army from destruction when they had been surprised by an Austrian attack in the early morning, and after a strong resistance sacrificed themselves to cover the retreat of the rest of the army.

Modern field artillery really began in France in the year 1756, when a distinct material was adopted for the field, siege, garrison, and coast services.

The field batteries were limited to 4, 8, and 12 pounders, and the 6-inch howitzer. The pieces were cast solid and bored out and had

a plain exterior. They were provided with lighter carriages, had iron axles, and were otherwise strengthened.

The increased ballistic properties of the gunpowder made at this time permitted of reduced charges without reducing the range.

The introduction of tangent scales and elevating screws permitted of more accurate and faster laying of the piece.

At this time the horses of the pieces were first harnessed in pairs instead of in file as before, and a limber for carrying rounds of ammunition provided.

The drivers of the carriages were civilians hired or impressed and were not a part of the battery.

One serious defect at this time was that many of the guns were known as battalion and regimental guns and were not assigned to permanent batteries.

The French were the first to adopt horse artillery (1791), and the English in 1793.

THE GUNS OF NAPOLEON.

In his first Italian campaign Napoleon assembled his guns into batteries and distributed them among his divisions. This was the first divisional artillery.

Napoleon was an artillery officer and appreciated its power. Under him artillery rose to a degree of importance before unknown. Appreciating the importance of mobility, Napoleon reduced the number of guns in a battery from eight to six; enlisted and uniformed his drivers; reduced the number of calibers, and assigned a heavy gun or howitzer to each battery.

When Napoleon was at the height of his power his artillery numbered some 60,000 men.

Artillery played an important part in every feature of Napoleon's tactics. If the infantry assaulted, its way was prepared by the artillery. If the cavalry charged it was to complete the work begun by the guns. If a portion of the army remained on the defensive, its power rested in the artillery.

He said: "It is the artillery of my Guard which decides most of the battles, because, having it always in hand, I can use if when and where necessary."

At Wagram Napoleon collected a great battery of 100 pieces and with their fire prepared the way for Macdonald's famous attack against the Austrian center. There are numerous other instances of Napoleon's massing guns, and in his last great attack against Wellington's left, at Waterloo, the way was prepared and supported by the fire of nearly 80 guns.

Napoleon's appreciation of artillery not only gained him many victories but it may be said to have been the cause of his final defeat,

as he held up his opening attack on the morning of Waterloo (June 18, 1815) from 8 o'clock till noon in order to allow the ground to dry out and permit of a better disposition of his artillery. In all his campaigns, as his infantry became less effective through losses in battle, Napoleon increased his proportion of guns. At Austerlitz it was 2½ per 1,000; at Wagram it was nearly 4 per 1,000.

At the beginning of the wars against Napoleon the British artillery consisted of mere trains. There were no batteries, the guns were assigned two to each infantry battalion. Each piece was drawn by three horses in single file, driven by drivers on foot.

Improvement was rapid, however. Drivers were enlisted, and in 1802 the guns were organized into batteries of six guns; the horses were harnessed in pairs, the drivers riding the off horse, six horses to each piece and four to the caisson; one howitzer assigned to each five guns. The guns were 6, 9, and 12 pounders and the howitzers 5½-inch brass pieces.

Wellington reports that the horse artillery was of great assistance to him at the battle of Waterloo.

Shrapnel was invented by a British officer, Lieut. Shrapnel, in 1792, but was not adopted till nearly 16 years later, when war compelled its use. As usual in such cases, the inventor was then dead and beyond the renown that his invention will bring to his name as long as war exist. Shrapnel was effectively used by the British against the raw American militia at the battle of Bladensburg (Aug. 24, 1814).

In the long peace following the battle of Waterloo, many improvements took place in artillery. The number of guns and calibers were again reduced; ammunition chests were placed on all limbers, with seats provided for the cannoneers.

In 1852 the French Emperor, Napoleon III, substituted for his former guns and howitzers a single 12-pounder fieldpiece which has come to be generally designated as the "Napoleon gun."

FRENCH-ITALIAN WAR.

In the Italian war of 1859 the French had a powerful artillery in which rifled guns first appeared. The new rifled guns were 4 and 12 pound muzzle-loaders; had an effective range of 2,500 yards, and, it was claimed, could put an opposing battery out of action at 1,700 yards.

The development of field artillery in the United States during the period of constant wars in Europe followed very closely that of the foreign armies. Its guns and equipment were, what little there was, of the same general type as those of the French and British.

MEXICAN WAR.

In the War with Mexico (1845–1848), the artillery was generally equipped with 6-pounder brass guns throwing only solid shot. Gen. Taylor, however, had with him three or four 12-pound howitzers, throwing shell, also a small number of 18-pounders. The Mexicans were armed only with 6-pounders throwing solid shot.

At the battle of Buena Vista, February 22, 1847, the batteries of Capt. Washington and Capt. Bragg, two batteries of eight guns each—16 guns—fought against the Mexicans almost unsupported. Gen. Taylor reports: "Without infantry to support it and at the imminent risk of losing its guns, Bragg's battery of 6-pounders came rapidly into action, the Mexican line being but a few yards from the muzzle of the pieces. The first discharge of canister caused the enemy to hesitate; the second and third drove him back in disorder and saved the day." Another battle saved by the valor of the artillery.

THE AMERICAN CIVIL WAR OF 1861–1865.

At the beginning of the war the field artillery of the United States consisted of eight batteries, two from each of the four regiments of artillery (coast) that then existed in the Army. Shortly after the outbreak of the war, in the Army of the Potomac, there were 92 "light batteries," a total of 12,500 men and 520 guns. The battery guns consisted in most part of 3-inch rifles and 12-pounder Napoleons. The Napoleons did better work than the rifled guns, at the short ranges, and were retained to the end of the war.

The effective range of the 3-inch ordnance gun was 2,800 yards; that of the 12-pound Napoleon, 1,520 yards.

The batteries of the Army of the Potomac at first contained six pieces but were later reduced to four; this number of guns per battery has been retained in our service to this day. Four batteries were assigned to each division, with half the divisional batteries organized into a corps reserve. One of the batteries of each division was a regular battery and its captain acted as chief of artillery for the division commander.

In the western armies the organization differed somewhat from that of the Army of the Potomac, a battery of artillery being assigned to each brigade of infantry.

In the Confederate armies a much better arrangement existed, a battalion of four batteries being assigned to each division. There was no reserve artillery; batteries were too scarce to admit of any being held out, they were all in use all of the time.

From the very beginning the field artillery of both Federals and Confederates was noted for its excellence. In the Army of the Potomac, the artillery was fortunate enough to have during most

of its existence as a chief of artillery, Gen. Henry F. Hunt, whose ability as a commander and organizer of the artillery of his time was of the highest excellence.

The topography of the country, particularly in northern Virginia, as at the Wilderness, gave field artillery very little to do during many of the campaigns of the Army of the Potomac, and it was often sent to the rear and its animals and wagons set to hauling supplies and rations.

Grant made the first important use of artillery in the Civil War at Shiloh, where he placed in position some two batteries of heavy siege guns about half a mile from the river and added to them other guns as they came up till some 50 guns were assembled. These guns, with some 4,000 supporting infantry, were all that, at the end of the first day, stood between the Federal Army and certain defeat.

At the battle of Malvern Hill, in 1862, the Federal artillery again played a most notable part in repulsing the Confederate attacks, firing shrapnel with great effect.

At Chancellorsville (May 2, 1863), both the Federal and Confederate batteries played a most conspicuous part. Gen. Hunt assembled 20 guns and turned them upon Stonewall Jackson's victorious advance, checking it and allowing the defeated Eleventh Corps to retire. Later in the same battle, Gen. Alexander of the Confederates seized Fair View Hill, enfiladed the Federal line with fire from some 34 guns, and turned the tide of battle in favor of the Confederates.

At Gettysburg, July, 1863, Gen. Hunt assembled some 80 guns and opposed to some 120 guns of the Confederates, held his fire and misled the enemy into thinking he had been silenced; when they attacked he was able to again open fire with such a storm of shell and shrapnel as to almost stop the entire advance by artillery fire alone.

The ranges of the guns during our Civil War prevented any extended cooperation of the artillery and infantry as would be done to-day. There was no attempt to concentrate large masses of artillery or artillery fire upon any particular point. The artillery simply accompanied the infantry into the combat and took its place in or in advance of the infantry line.

THE SEVEN WEEKS' WAR.

In the Seven Weeks' War between Austria and Prussia, each side took the field with a large and well-equipped force of artillery. Each field battery consisted of six guns of steel breech loaders, though the 12-pound smooth bore had not entirely disappeared. The rifled piece fired a shell weighing 15 pounds, and the smaller piece, one weighing 9 pounds. Shell fire was almost exclusively used and the

shells were fitted with percussion fuses. The proportion in each army was about 3.6 guns per 1,000 men.

The Prussian artillery in no way distinguished itself; it seems to have been afraid of encountering infantry fire and was continually withdrawing to refit and renew its ammunition supply; on the march it was held too far to the rear and rarely got into the battle in time to be of the most use.

Among the critics of the feebleness of the Prussian artillery none were so severe as the Prussians themselves, and the determination with which they set about to improve that arm was apparent four years later, 1870, in their war with France, where the proper use of artillery was exemplified as never before.

The proportion of guns to men in the German Army at this time was 3.7 guns per 1,000 infantry.

FRANCO-PRUSSIAN WAR.

During the Franco-Prussian War for the first time appeared the mitrailleuse, the machine gun of the French.

From the beginning to the end the French artillery was outnumbered, outmaneuvered, and outfought. The Prussian guns were handled with skill and audacity and made their power felt from the beginning to the end of every battle, while in most cases the artillery of the French was thrown into the engagement piecemeal and speedily knocked to pieces.

The battles were fought by the artillery of the contending armies at ranges little, if any, over 1,500 to 1,600 yards.

A very good illustration of the mistake as to the effect produced upon the troops of an enemy is given by the battle of Gravelotte (Aug. 18, 1870). The Prussians concentrated the fire of some 84 guns on the French position for more than an hour at 1,650 to 2,200 yards, and apparently had silenced the French guns; the assumption was made that the French infantry was also badly shaken. The attack was made, and it was found that the Prussian artillery had produced little effect on the French, that the French guns had simply suspended their fire to await the assault. The Prussian advance was received with a storm of shrapnel and rifle fire and stopped with great loss at a distance of 500 to 800 yards from the guns.

The battle of Sedan (Sept. 1, 1870) was the greatest artillery battle of this war and probably the greatest up to this time in history. German batteries aggregating 540 guns formed a circle around MacMahon's army, preventing the advance of the French infantry; ranges were not over 2,000 yards. The official reports of the French commanders say that they were defeated by the fire of the German artillery alone.

The advance made in artillery tactics during the Franco-Prussian War can be summed up as follows:

On the march the German artillery was pushed well to the front, being preceded only by enough infantry to prevent surprise. It then came into action quickly and in large numbers and took its targets from the condition imposed by the objective of the infantry. Its fire was accurate and was employed in ranges up to as high as 3,500 yards.

The French wasted their fire in too long ranges, held their guns too far to the rear in the march column, and when they did send them in, often sent them in singly instead of in masses.

RUSSIAN-TURKISH WAR.

In the Russian-Turkish war of 1877 the guns of the Russians were bronze breech-loading rifles of 6 and 9 pounders; the projectiles used were shell, shrapnel, and canister; the shell weighed about 24.3 pounds, the shrapnel about 29.48 pounds, for the 9-pounder gun, while for the 6-pounder the shell weighed 12.6 pounds and the shrapnel 15.19 pounds. The proportion in the Russian Army was 3.9 guns per 1,000.

The Turkish matériel was superior to that of the Russian, being composed of Krupp steel, breech loading, rifled guns of 8-centimeter (3.15-inch) and 9-centimeter (3.54-inch) caliber.

The Russian artillery is said to have consumed several thousand tons of ammunition and to have contributed to no victory and to have averted no defeat.

In considering the history of artillery up to this time, its development is shown to have been along the same lines as that of the infantry—increased mobility with more effective fire action. The whole aim of the artillery has been to bring an overwhelming fire effect upon some part of the enemy's line at a critical period of the battle.

THE SPANISH-AMERICAN WAR OF 1898–99.

The artillery with the American Army during the Santiago campaign consisted of one light artillery battalion of four batteries, hastily gathered together, without previous battalion training, under the command of a coast artillery major. There was also a siege artillery battalion of two batteries, and a dynamite gun with the Rough Riders.

The field guns were of 3.2-inch caliber, of built-up steel, and fired a projectile weighing 13½ pounds, propelled by 3.5 pounds of black powder; powder and projectile in separate parts.

The siege guns were 7-inch howitzers, built-up steel, firing a projectile weighing 105 pounds with 10 pounds of black powder.

Both guns were breech loaders. The most effective range of the 3.2 guns was about 2,500 to 3,000 yards, while the 7-inch howitzer could do effective work up to 5,000 yards. There were also two Colt automatic guns that seem to have done very good work, though they would have been better off had they been mounted on wheels instead of tripods.

One of the complaints against the artillery at Santiago was their small number, less than one gun to 1,000 men. For the first time in history, and let us hope the last, artillery, firing out-of-date guns, with black powder, was engaged with an enemy armed with modern guns firing smokeless powder. Our artillery found its aim obscured by the smoke and at the same time presented an excellent target to the Spaniards.

The infantry claimed that the guns were posted too far to the rear to be of the best service. However, they were within effective range of the enemy's trenches, 2,500 yards, and were able to do effective shooting.

The infantry wanted Civil War tactics with the guns right in the infantry line. It will be but seldom that the infantry can expect such close support in the future; they will be supported by fire rather than by the actual presence of the guns.

The campaign of Santiago was a short one and nothing of importance in an artillery line was developed other than the fact that shrapnel, propelled by high-power smokeless powder, is the most powerful type of projectile against troops in the open yet produced.

THE SOUTH AFRICAN WAR OF 1899–1902.

In this war the British far outnumbered the Boers, both in troops and number of guns, thereby reducing the tactics of Boers to, in most cases, simply acting on the defensive.

The artillery, ever the most highly prized arm of the British Army, had great mobility, its maneuvering and shooting were good, but it was not sufficiently trained in indirect fire tactics or in working with or shooting over its infantry.

Nearly all of the leaders of the British preferred to use their batteries singly, rather than to employ them in larger units. For the first period of the war their tactics consisted of a rapid advance in the open to within an effective range of the enemy—1,500 to 3,000 yards.

The British artillery at this time was trained for detachment warfare, and not for a large battle.

The guns of both the British horse and field artillery had the same caliber, 3 inches, but did not fire the same weight of projectile. Only shrapnel and case shot were carried. The shrapnel of the field guns

weighed 14 pounds, with 200 bullets. The horse guns were lighter and fired a 12-pound shrapnel with 156 balls. The extreme range of the field guns was 6,000 yards, but as its fuses were graduated only up to 3,360 yards, that was the effective limit of the shrapnel. The horse gun had an extreme range of 5,500 yards, with fuses to 3,690 yards. The fire effect of the field guns was assisted by batteries of 5-inch howitzers, firing a 50-pound shell filled with lyddite.

These guns were found to be not powerful enough and naval guns on improvised carriages were added. These guns were 12-pounders of long range, 4.7-inch caliber.

Vickers-Maxim mountain guns of 2.95-inch caliber, the same gun our mountain artillery is now armed with, were also occasionally used.

Up to 1896 the Boers had very little artillery. About that time, however, they ordered in Europe, sixteen 6-inch Creusot guns, "long toms," and four 4.7-inch Krupp heavy guns (howitzers). These, with a varied collection of field guns, a number of machine guns, "pom-poms," were on hand in the Transvaal when the war commenced.

The British give the following as the Boer artillery:

Eight heavy guns:
- Four 6-inch long toms (Creusots), shell weighing 103 pounds.
- Four 4.7-inch Krupp howitzers.

Nineteen field guns:
- Six 3-inch Creusot quick-firers.
- Eight 3-inch Krupp quick-firers.
- Five 3-inch Vickers-Maxim quick-firers.

Twenty-four pom-poms, 1.45-inch Vickers-Maxim machine guns.

All of the above guns fired smokeless powder and were plentifully supplied with ammunition, there being a shell foundry at Johannesburg.

The Orange Free State had:
- Fourteen 3-inch old Krupp guns, firing black powder.
- Four 1.45-inch machine guns.
- Six other machine guns.

At first the Boers attempted to use their guns in batteries as in Europe, but, finding that it hampered their mobility and necessitated their forces remaining in large detachments, they used their guns singly; every advantage was taken of cover and position changed as soon as the British obtained the range.

In none of the engagements in South Africa was the British infantry given proper support by its artillery. In most cases, without proper reconnaissance, the guns were advanced rapidly to the front, unlim-

bered, and fire opened on the "supposed positions" of the enemy. In many cases the enemy's trenches were not reached at all and when the infantry advanced, it was met by a heavy rifle fire from the Boer trenches and suffered heavy loss.

As soon as the infantry advanced, the artillery ceased firing, in many cases remaining in "Observation," fearing to fire over their own troops.

The lyddite shells of the howitzers and naval guns, of which so much had been expected, proved of little use for field service. The effect on the well-intrenched Boers was small; when they burst they made a great noise, but the fragments were few in number and the gases evaporated quickly. The Boers escaped their effect by hugging the ground and soon became accustomed to the noise.

The Boers placed their guns in concealed positions; used indirect fire and fired over the heads of their advancing infantry, the shell frequently bursting only 30 to 100 yards in front of the Boers' firing line without doing any damage to their own troops. When necessary to repulse an attack, the Boers did not hesitate to push their guns well forward in the firing line and serve them with direct fire at short ranges.

The South African War presents to the artilleryman one of the best examples of a weak force operating on the defensive, taking advantage of their superior mobility and knowledge of the country, to depart from the hidebound tactics of the drill books and fight a superior force, who, with true British obstinacy, refused to depart from the teachings of the drill ground until obliged to do so by numerous lessons of a very humiliating character, and to obviate total defeat.

THE RUSSIAN-JAPANESE WAR OF 1904.

For the first time in history this war brought together on the field of battle two nations, both armed with modern artillery weapons.

The Japanese field artillery was armed with an 1898 model Arisaka gun, a sort of near relative of the modern field gun of to-day. It was of 75-millimeter caliber (2.95-inch); accelerated fire, rather than quick-firing; had no recoil on the carriage and no shields; it fired two projectiles, shrapnel of 13 pounds and an explosive shell of 11-pounds. Initial velocity was about 1,600 F. S. A battery consisted of six guns; the range was about 5,000 yards.

The Japanese mountain gun was very much of the same type, but was much less powerful; I. V. of about 850 F. S., with a range of 3,000 yards. Both guns had a screw-breech mechanism and checked the recoil by drag shoes with spikes or spades underneath. The ammunition was carried in horse carts or on pack mules. The ammunition was of that kind known as "separate," that is, the projectiles and

powder charges were in separate parts. These pieces did not possess all the modern improvements they should have had, considering the date of their make. They lacked mobility and rapidity of fire. The horses and harness were poor and the drivers worse.

The Russian Army was armed with a gun, model of 1902; Engelhardt type; caliber 3-inch (76 mm.); rapid fire; carriage recoil, but no shields. I. V. was 1,915 F. S., and had but one projectile, shrapnel, about 15 pounds. The battery of eight pieces was commanded by a lieutenant colonel. The mountain artillery provided was poor and out of date.

In January, 1904, the Russians ordered new field pieces, but they did not reach the army till the end of the year.

At the outbreak of the war the Russian batteries present in the theater of operations were largely armed with the following types of guns:

(*a*) A heavy "battery cannon," 10.67 centimeters, 4.2-inch model 1877.

(*b*) A cannon of 87 millimeters, called a light cannon (3.4-inch).

(*c*) A mountain gun of 68.5 millimeters (2.69-inch).

These old models soon gave way to newer ones sent from Europe, but during the entire course of the war a few batteries of the "battery cannon" were used. The Russian matériel had an incontestable superiority of power over the Japanese, but the troops that used it were not familiar with its powers and limitations. It was by hard lessons and the loss of many guns, in the opening battles, that they came to a right judgment of the gun and a knowledge of its use.

For larger guns, field howitzers, etc., the Russians had only out-of-date mortars, inaccurate and of short range. The Japanese had a more modern heavy gun, but only used it under siege conditions.

When the Russian war began, there was no fact learned from experience to enlighten the artillerymen as to the tactical modifications he would find necessary to meet the changed conditions affecting his gun. These changes in the artillery were the more marked as the change due to increase in the rapidity of fire was greater in that arm than in any other.

It was remarked that during this war the battlefield was empty of artillery and only on necessity did the infantry show itself in the open.

French artillerymen had stated these principles in the abstract; the Russian-Japanese War gave them the sanction of experience.

At first all the advantage rested with the Japanese, with their relatively weaker gun. They had been supplied with their matériel for a longer time and knew how to handle it more skillfully, while the Russians were supplied with a new matériel that they were required to learn to handle upon the eve of combat.

The great lesson of this war is, artillery should occupy, from preference, whenever possible, masked positions. The Japanese knew, and took advantage of this from the first.

On July 17, 1904, a Russian lieutenant colonel, in command of one of the batteries, wrote: "Up to the present time none of our battery commanders have seen the enemy's guns or even for the most have they known from what direction the fire was coming." The Russians soon learned their gun and before the end of the war were giving more than they received, and getting much more out of the superior gun than at the beginning.

The following is an excellent example: August 29, at midnight, a Russian battery commander (lieutenant colonel) received orders to occupy a position that would permit him to support the artillery of the Third Corps and also fire upon the hostile cavalry in front of this corps. The mission was a delicate one. It was necessary to proceed to, and occupy, a position at night, and that without reconnaissance, and to be in position at daybreak against an enemy whose dispositions were but little known.

The colonel studied his map; chose his position; had it reconnoitered at 3 a. m., and at 5.30 had his two batteries in position ready to fire. The range, by map, was given between 2,800 and 3,200 yards.

The battery commander's observing station was a steep hill almost directly behind the center of the infantry line. Having climbed the steep slope, the colonel paused for breath. Under what conditions would he discover the enemy, which was just beginning to be revealed to him through the early morning light? The Japanese had opened a heavy fire at daybreak, the flashes of their guns could be seen on the summit of the hills before him. There were four distinct groups of the enemy covering a front of some 2 miles.

The colonel said: "I found myself in the position of the hunter who had climbed a mountain to stalk a single wild sheep and found an entire herd." He directed the fire of the second battery against the right of the Japanese line; corrected the deflection and sent the range and angle of site, all by flag signal. Ten minutes of suspense, then the colonel gave the signal for rapid fire for all, or rather both, of his batteries. Twenty minutes later the 24 guns of the Japanese ceased firing. The colonel continued with deliberate fire to hold the enemy in position, and, watching the terrain in front of him with his glasses, saw the Japanese infantry advancing from the protection of a hill to his front, toward a field of millet, with the intention of delivering an attack from that position. After making certain that a concentration was taking place there, he opened fire with the second battery. The success was extraordinary. The salvo burst directly in the field of

millet; the second command came at once: "Rapid fire;" the Japanese ran out of the field like scared rabbits and were cut to pieces by the fire of the infantry supported by the artillery. The Japanese batteries searched for hours for the position of the Russians, but never found them, and for the entire day the batteries escaped without damage.

The cause of concealed positions and indirect fire was won.

THE BALKAN WARS OF 1912–13.

The first Turko-Balkan War began October 17, 1912. This was in effect the first war in which two artilleries, both modernly equipped and organized, but of different schools, had clashed. On the Turkish side, the German matériel, instructed, directed, and even commanded by German officers. On the side of the Balkan States (Bulgaria, Servia, Greece and Montenegro) the French matériel and system, commanded by officers trained in the French school.

As our own artillery is modeled after the French, it is interesting for us to note which side had the most pronounced success.

THE TURKISH GUNS.

The field artillery had the 7.5-centimeter (2.95-inch) quick-firing Krupp gun and the 8 and 9 centimeter (3.15–3.54 inch) Krupp guns.

The heavy field artillery was armed with the 12-centimeter Krupp field howitzer (4.7-inch).

The mountain gun was Schneider-Creusot quick-firing 75's (2.95-inch) and a 7-centimeter Krupp gun. Field guns had about 500 rounds per gun with the batteries. Mountain batteries, about 130 rounds per gun.

THE BULGARIAN GUNS.

Quick-firing 75-millimeter Schneider-Creusot and 87-millimeter and 75-millimeter Krupp guns; 500 rounds per gun of ammunition, both shrapnel and common shell, in proportion of three shrapnel to one shell.

Heavy artillery of 12 and 15 centimeters (4.7 and 5.8 inch) from the Schneider factory. From the comparison of the Turkish and Bulgarian artillery, the Germans gained some degree of consolation for their Krupp gun, claiming that there was no question of a proved superiority of the French matériel over the Krupp, that both sides used in the war German and French makes. They claimed it was simply a case of poor handling. However, as the Turkish artillery was all German taught and even led, it would seem that they, the Germans, had rather the worst of the argument which ever way it is put.

THE SERVIAN GUNS.

The Servian artillery was of modern Schneider-Creusot guns 7.5, 8, 12, and 15 centimeters; the regiments were of three battalions of three batteries each of four guns. Here we notice the modern artillery first getting down to a four-gun battery. The improved rate of fire had shown that a larger number of guns grouped under one head was more than one officer (captain) could direct with the best results.

THE GREEK GUNS.

The field artillery was armed with Schneider quick-firing guns in all respect the same as Servia and Roumania, 75 millimeters; a field howitzer of 4.2 inches, firing a shell of 35 pounds with a minimum velocity of 985 feet per second. The ranges of all guns were about the same. Light guns 7,000 yards, light howitzers, 8,000 yards, heavy guns 11,000 yards.

The Montenegrin guns were a rich and rare variety of ordnance. Most of it was obselete, having been presented to the country by their King.

The proportion of guns to 1,000 infantry was about the same in all of the allied states, namely, 5.3. The Turks were not so well off in this respect, having not over 3.5 to 4 guns per 1,000.

The Turkish artillery of Krupp matériel, and only about one-half modern, was poorly handled and rendered inefficient service. The difficulty of developing an efficient artillery service in the Turkish Army is great, owing to the scarcity of soldiers who have enough elementary education and mechanical ability to enable them to be trained as gunners.

The Servian artillery, taken as a fair example of the allied artillery, was of the highest type and showed the result of an excellent system and extensive training. At the battle of Kumanova the Servian artillery turned all their batteries at first against the Turkish artillery and silenced it. This was comparatively simple, as the Turkish batteries were forced into the open to bring their fire on the Servian infantry, which they opposed without concerning themselves to reply to the Servian artillery. Having thus assured themselves freedom of action, the Servian batteries directed their fire against the Turkish infantry and produced such effect that the Servian infantry had an easy time in pushing home their attack.

Two Turkish batteries in the open were put out of action as soon as they opened fire, while a third battery, established behind cover and using flash defilade, with an oblique fire, stopped the advance of the whole Servian Corps, till silenced by converging fire from field and heavy artillery. In fact, the field artillery was able to do nothing with this battery until reenforced by the fire of the heavy guns.

SOME CONCLUSIONS FROM THE BALKAN WARS.

Artillery in a well-concealed position can sustain itself against superior fire effect for a long time. The artillery duel is necessary; the side that refuses it is liable to find itself destroyed. The side that undertakes it, and with success, will be able to fight with two arms (its infantry supported by its artillery) against one (the infantry) of the enemy.

Oblique fire of artillery is superior to frontal fire.

The consumption of ammunition is limited only by the amount available and necessary for the particular object in view.

Commanding officers' observing stations and observation ladders are a necessity in flat country and desirable at all times. They keep the battery commander near his guns and facilitate control and observation, and particularly quickness in opening fire.

The use of long-range guns with a curved trajectory and high-explosive shells is necessary, and particularly if used by but one of the two sides; it quickly gives him the advantage.

Mountain artillery, because of its great mobility, will be most often used as accompanying batteries.

The one really new point brought out during these two wars was that of the operations of aeroplanes, particularly in connection with adjustment of artillery fire on concealed positions.

The artillery needs aeroplanes from the beginning of the infantry engagement, and some of these aeroplanes should be attached exclusively to the artillery and be accompanied by trained artillery observers.

FIELD ARTILLERY IN THE EUROPEAN WAR.

The artillery of all the nations engaged in the present European war is armed with some sort of a modern rapid-fire piece of approximately 3-inch caliber. At the outbreak of the present war heavy artillery was not so thoroughly developed and not so universally adopted as was the 3-inch rapid-fire piece, of which the famous "75's" of the French is the best known.

The Germans had appreciated the advantages of the heavy weapon, and at the outbreak of the war were far ahead of all other nations in this regard. The other nations had a few heavy guns at this time; the Russians the most, but none were as large of caliber as those of the Germans or as numerous.

Germany has some 10 types of field guns. Howitzers and mortars running from 77-millimeter (3.03-inch) quick-firing field guns to the famous 42-centimeter (16.5-inch) heavy siege mortar.

France has some 12 types, from the famous 75-millimeter (2.95-inch) field gun to a 340-millimeter (13.8-inch) gun, mounted on a special railway carriage.

The French, by latest reports, have put in commission a 370 millimeter (14.6-inch) howitzer.

The first British expedition was equipped with 4.5-inch field howitzers and 5-inch field guns. Reports have it that they now have on the line "somewhere in France" as large and powerful guns as any of the Germans.

Russia has the following equipment according to latest reports: From 3-inch light field guns to 6-inch field howitzers. She has lately put into action several types of heavy guns of the general type of the Germans, but it is thought that she has not as yet any as large or as powerful as those of her principal adversary, the Austrians.

Anti-aircraft guns are used extensively, having a high angle of fire; an all-around travis and a high initial velocity. The present guns have a range of close to 10,000 feet. The effect is, however, very little, as an aeroplane is seldom brought to ground. The chief effect is to keep them so high in the air as to spoil their usefulness.

Excellent use is being made of motor transport during this war, particularly for guns of large caliber and heavy weight. The excellent roads of Central Europe lend themselves to this class of transportation much more than might be expected in this country.

Due to aeroplane observation, gun positions are chosen with great care and fully concealed. The new lesson taught in this respect is that to place artillery behind cover and concealed from view is not enough; it must be concealed from overhead view also.

Protection from the fire of the heaviest field howitzers can not be found or made; protection is only secured by concealment. When the position of a battery is found by the enemy it is moved to another position, or, if that is not possible, the personnel is withdrawn to a sheltered place and darkness awaited.

In the trench warfare now the rule on the European firing lines, artillery rarely sees anything to fire at. Aeroplanes report the general position of the enemy's troops and then by the expenditure of an immense amount of ammunition, it is sought to smother the vicinity within which the enemy has been located.

Reports from observers and military attachés show that, in general, all the warring nations are using all the guns on which they can lay hands, irrespective of type, year, or construction, whether field, coast, or navy. All they seem to want is guns and then more guns.

PART II.

THE PROGRESS OF MODERN FIELD ARTILLERY.

The invention of smokeless powder between 1880-1890 caused a complete revolution in the armament of field artillery. The new propelling agent burned almost without smoke and had an increased initial velocity with the same or less weight of charge.

The artillery at first contented itself with profiting by the advantages given by an almost complete absence of smoke, which greatly reduced the difficulties of pointing. Soon, however, there was a remarkable increase in the rapidity of fire, and automatic brakes were invented that greatly reduced the hard work of returning the gun to battery after firing. There was an effort to increase the effectiveness of the gun by adding to that of the individual shot as well as to increase the rate of fire.

The design of the projectile was changed and improved. The most important projectile against troops in the open is shrapnel and its effect increases with the number of balls. The first shrapnel were made from cast iron; now the case is made from steel. In order to have a large number of balls the size of the balls was reduced and the size of the interior chamber of the shell was increased. The old shrapnel gave some 30 fragments upon burst; the modern some 300.

Metallic cartridge cases were introduced and cloth cartridge cases were replaced by metallic cases to hold the propelling charge and primer. Later the case was united with the projectile, the whole forming a cartridge.

The pointing arrangements of the gun have also been improved; the shank of the rear sight has been made in the form of a circular arc with an attached level. The elevation is no longer given by the use of a front and rear sight, but by use of this level.

In the old guns the piece could not be moved laterally on the carriage. To point in direction the whole gun had to be moved. With the new matériel, the gun pointer has only to turn a hand-wheel to move the gun about a vertical or horizontal axis.

The ideal field gun is the gun which has sufficient stability to permit of firing several shots in succession without repointing and without loss of accuracy.

This has been realized in guns which recoil on the carriage.

All guns which recoil on the carriage are composed of three principal parts.

1. The carriage proper, with the axle and wheels, which can be fixed to the ground by means of the trail spade.

2. The top carriage, called the cradle, which rests on the main carriage and has a slide on its upper part.

3. The gun, which after each shot moves to the rear upon the slide.

This motion to the rear is checked and controlled by a cylinder, a piston, and piston rod.

The cylinder is fixed to the rear position of the gun and the piston rod to the front part of the cradle. When the gun recoils the cylinder goes with it, sliding with slight friction on the piston, which remains fast. The cylinder is filled with an oil, "hydroline," which is characterized by its low freezing point and by its non-corrosive action on metals. In an emergency almost any other kind of oil, or even plain water may be used.

The oil in the cylinder is forced from one side of the piston to the other through small openings. In addition, the force of the recoil compresses a strong helical spring, which is assembled in three parts about the cylinder. These springs absorb part of the force of the recoil and return the gun to battery. The return to battery is checked and controlled by the oil in the cylinder passing again through the narrow openings in the piston and by the counter recoil buffer, a tapered bronze rod which fits with small clearance into the piston rod (bored to receive it). From the fact that the cradle does not recoil with the gun, the gun pointer can begin to relay the gun during its return to battery.

By an arrangement of handwheels on both sides of the carriage and attached both to the elevating and traversing mechanism the elevation of the gun may be changed at will without changing the line of sight, which can be kept constantly upon the target. (This is what is known as the independent line of sight.) If desired, the line of sight and the elevation can be changed at one time by the use of only one handwheel, the wheel on the left of the piece. This arrangement greatly shortens the time of laying. The gun pointer, in indirect fire, has only to keep the line of sight on the target, while his No. 1, on the other side of the piece, gives the proper elevation corresponding to the range ordered, which he has set off on the quadrant. With specially trained gun crews, rapid fire guns have obtained a rapidity of fire of from 20 to 28 shots per minute.

The mobility of a field gun depends principally upon the weight behind the teams. In time of peace the constant call has been for more mobility and less weight behind the teams. During war the constant call has been for more power, and consequently more weight behind the teams. The call for more ballistic power has been clearly shown during the present European war; witness the famous 42 centimeter guns of the Germans.

The present European war has also shown that the proportion of shrapnel and shell with the batteries was wrong, at least for the

class of fighting carried on in France. The proportion has been almost exactly reversed. Where before shrapnel was the principal ammunition carried, now it is the high explosive shell that is most needed.

The immobility of the new piece during firing permits steel shields to be attached to the gun and caisson, which protect the gun crew from rifle and shrapnel bullets.

ARTILLERY FIRE.

Artillery fire comprises two distinct periods—fire for adjustment and fire for effect. Fire for adjustment has for its object the determination of the range, the fuse setting, and the deflection. Fire for effect has for its object the destruction of the matériel or the stationary portion of the target, with a holding stationary of the mobile portion of the target.

Adjustment begins with seeking a bracket—that is, the determination of two points within which the target surely lies. The first bracket sought is usually one of 200 to 400 yards. This bracket is then halved by firing at the mean range, and so on, till the desired accuracy is obtained.

A strong effort must be made to have great quantities of ammunition on hand, and provision must be made for its replenishment. It is of the greatest importance that the firing battery have a large supply on the firing line. To do this, the firing battery must bring to the firing line more caissons than guns.

All guns have a caisson body placed near it, usually on its left, with two extra caissons placed on the flanks of the battery position, with some eight caissons, the battery combat train in reserve, under cover, in the near vicinity.

The supply for a battery in our service is 1,432 rounds per battery, 358 rounds per gun.

PART III.

EMPLOYMENT OF FIELD ARTILLERY IN THE FIELD.

GENERAL REMARKS.

The plans and intentions of the general commander must be known to the officer commanding the artillery, in order that the artillery may fully cooperate with the other arms and so regulate its fire as to effectively support the end in view. The higher artillery commanders should maintain control as long as possible without interfering with the proper initiative of their subordinates. Until the fight has developed beyond the opening stage, it may not be possible to say in the attack which will be the more important target for the guns, the enemy's guns or that portion of the line it is proposed to attack. As a general rule, however, the guns should fire on that portion of the enemy's line that is at that moment delivering the most destructive fire. This must be decided by the general commander, and the artillery must carry out his instructions without regard to the effect upon themselves.

In the defense, the plan of the general commander and the end sought must also determine the target of the artillery, with the exception, however, that as a general principle the artillery should fire upon that part of the enemy's troops that are at the moment the most to be feared.

The extent to which artillery can assist its companion arm, the infantry, will depend much upon the action of the enemy and the plan of the higher commander. If the enemy's artillery opens fire in the early stages of the action, every effort must be made to subdue him, and the employment of indirect fire from concealed positions will in most cases offer the best results. If, on the other hand, the enemy's artillery should hold his fire and refuse to reveal his positions, then it is the duty of the advance infantry or cavalry to force him to do so, while the artillery takes up such positions in readiness as will enable an effective fire to be opened when the target is revealed.

Only such guns as are necessary for the work in hand should open fire; the other guns should remain in a position of readiness or observation. This does not mean, however, that any of the guns should be held in an actual reserve out of the battle. Artillery's best reserve consists in a large ammunition supply.

The best results from artillery fire will, in most cases, result from sudden, short, and sharp periods of fire with indeterminate pauses, rather than from continuous and deliberate fire.

As indicated in several examples in the preceding pages, too much importance can not be attached to the concealment of the guns, not only in action, but while advancing to the chosen position. While the saying that "a battery seen is a battery lost" is not true in all cases, still it is so nearly so that a battery commander who neglects any possible precaution to conceal his guns is guilty of a very grave error, if of nothing else.

Concentration of fire is as important now as ever, but this concentration of fire is not now always obtained by a concentration of guns. The improvements in appliances for indirect laying, with the increased range of the guns, allow fire to be concentrated upon a given point, while the guns actually delivering the fire occupy widely separated positions.

Infantry moving to the attack can expect the same close support of the artillery as they have always had, but with this difference: The artillery will accompany them with fire and not actually with the guns.

The protection of the artillery is intrusted to the other arms, usually to some designated body of troops told off for that duty by the higher commander. However, it is the duty of all troops in the vicinity of artillery to furnish them all the protection the actual conditions will permit.

Since artillery is effective only when in action, frequent changes of position should be avoided. A few hundred yards of range, if within the effective range of the gun, does not affect the value of artillery fire. The fire of field artillery is dangerous against any troops in any formation, anywhere within the range of the gun.

A shell or shrapnel or the head of a high explosive shrapnel is just as effective and will do as much damage at 6,000 yards as at 1,000 yards. A shrapnel bursting at the proper interval in front of a line of infantry at 6,000 yards will do as much damage as one bursting at the proper interval at 1,000 yards. While the above is true, the amount of ammunition necessary to obtain this proper interval of burst, the amount of errors in observation, the difficulty of ranging, height of burst, etc., is some four times greater at 6,000 yards than at 1,000 yards. It has been calculated that where at 1,000 yards with shell fire only one shot is required for a direct hit, at 6,000 yards it requires some 263 shots for one direct hit.

Artillery firing over its own infantry will be the normal procedure and ought not to be viewed with dread, either by the infantry or the artillery. At ranges around 5,000 to 6,000 yards this support can, in most cases, be kept up to as close as 400 yards of the enemy's position; at shorter ranges, say 2,500 to 3,500, the French and German claim some 300 yards as the limit. The English, however, place the short limit at 100 yards or even less. This last is thought to be too

close a support; however, as the artillery is the one delivering the fire and not the one liable to be injured by the short burst, it is more essentially a subject to be determined by the infantry, whether, for instance, the close support of the bursting projectile, with an occasional shrapnel or shell burst among themselves, is to be preferred to the full effect of the enemy's unhindered fire.

FIELD ARTILLERY ON THE MARCH.

Field artillery on the march usually marches in column of sections, sometimes in double-section column. The habitual gait is the walk, though the trot may be taken up for short distances over good roads.

Rates of march are as follows: Walk, 4 miles per hour; trot, 8 miles per hour; gallop, 12 miles per hour. The length of a daily march of artillery is the same as the command of which it forms a part; if alone, it marches 15 to 20 miles per day.

In most services, our own included, the gallop is going out of fashion. It is useful in bringing up guns that have fallen behind and in crossing danger zones. It is an unnatural gait for a draft horse and usually more time is lost, in the confusion of going into action at a gallop, than is gained.

A battery of field artillery takes up a distance of 400 yards on the road; a horse battery, 460 yards; a mountain battery, 358 yards. A regiment of field artillery occupies 2,800 yards; a horse regiment, 3,160 yards; a mountain regiment, 2,548 yards.

In marching, artillery always keeps to the right of the road, leaving the left open for other purposes.

The guiding principle that there should always be at least a day's supply of ammunition within reach and a further supply obtainable during the night, of a necessity places the caissons of the battery-combat train with the guns, until the battery prepares for action, then the combat train takes up some suitable place under cover in the near vicinity.

In another case the combined combat trains of a battalion will be marched together at the rear of the battalion, or even the trains of the whole regiment may be combined and marched in rear of the regiment. This is an exceptional case, however, as it places the ammunition supply of the leading batteries too far from their guns.

ARTILLERY WITH THE ADVANCE GUARD.

The action of the artillery with the advance guard will vary with the object the advance guard has in view. It should be careful, however, not to occupy a position from which it could not be withdrawn and thus bring on an engagement in a place not in accordance with the plans of the higher commander.

The duty of the guns is to break down any resistance which prevents the steady advance of the main body. The guns should be concealed as much as possible and advantage taken of their rapidity of fire to mislead the enemy as to the number of guns opposed to him. This might lead to the wide dispersion of the guns in platoons, or even sections of a single gun.

The only invariable rule to be followed in selecting an artillery position is to so place the guns as to be able to carry out the task assigned to them.

Positions, having concealment from view, that are not on the skyline or those in rear of a crest, with a clump of trees in front of the gun position, increase the enemy's difficulties and offers the best chance of success.

RECONNAISSANCE.

The duty of locating the enemy and of securing information concerning him in general develops on troops of the other arms. This information should be promptly transmitted to the artillery. The artillery must, however, obtain for itself such special information as is necessary for the proper employment of the guns. It is advisable to attach artillery officers to advance troops for the purpose of reconnaissance and to furnish information to the artillery commander during the infantry advance.

Preparation of fire consists, primarily, in determining the settings to be given to the various laying instruments so that the fire of the guns will be directed upon the designated target. The pieces must be given the proper elevation for range; the fuses must be set to give the proper height of burst. These necessary settings are indicated in the firing commands, which are sent to the guns under the head of firing data.

The principles of direct fire are so well known that I will not discuss them here.

If the target can not be seen from the guns, the method of fire is called indirect fire. In this method of fire, though the men actually working the guns can not see the target, the officer conducting the fire must be able to see both the target and the position of his right piece, communication being kept up by means of the voice, telephone, or flags.

FIRING DATA.

First, a common aiming point is selected for all the guns, which may be any well-defined object that can not be easily confused with other objects in its vicinity, and as distant as possible. This aiming point may be in any direction from the guns, the panoramic sight allowing of vision to any point of the compass, but should not be too

"oblique" to the normal (front of the battery). It is better when nearly to the front or rear of the battery or on one or the other flank.

The battery commander determines the deflection between the aiming point and target from his position with an instrument called the battery commander's instrument, which measures in mils both vertical and horizontal angles; corrects that deflection for the distance he is away from the position of his right piece; sends the corrected deflection to the battery, where it is set off on the deflection scale of the panoramic sight. The sight is then laid on the aiming point and the gun directed upon the target.

I claim no originality for any of the foregoing. It is simply a collection of interesting facts—at least I hope they have been interesting—concerning field artillery, its history and development, and some of the most prominent characteristics of modern field artillery in general.

These facts have been collected from authorized textbooks of our own and foreign armies, from tanslations from the French and German, from lectures delivered by various field artillery officers, instructors here at the Army Service Schools, and from their published books.

The sources are too numerous to mention by name. I desire, however, to thank all whose words or thoughts I have used.

I will now show you some lantern slides with the idea of showing pictorially some of the different types of guns mentioned in this paper.

1. 7-pounder gun, so called from the fact that it fired a 7-pound projectile. Model of 1786.
2. 9-pounder Napoleon gun. Model of 1861.
3. 3.2-inch breech-loader, the type of gun used during the Spanish-American War.
4. Illustrating the tactics of the Civil War. Guns of battery in the infantry firing line.
5. Gen. Hunt, the most prominent artilleryman on the Federal side, during the Civil War.
6. The battle of Shiloh, notice the guns in the infantry line.
7. The Arisaka field gun of the Japanese, during the Russian-Japanese War.
8. 2.95-inch V. M. mountain gun, used in United States service during the Spanish-American War and up to the present time.
9. V. M. mountain gun. The tangent sight shown in position to left of breech block has been replaced by panoramic sight.
10. V. M. mountain gun, model of 1910 (English).
11. Battery mule transporting trail of gun.
12. Gun section of mountain battery, notice the cradle, wheel and axle, and gun on mules' backs.
13. Anti-aircraft gun.
14. Lewis machine gun, an American invention.
15. Anti-aircraft gun.
16. Anti-aircraft gun.
17. An armored French aeroplane.
18. An armored motor car.

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19. Good roads in America.
20. The French Q. F. field gun.
21. The Italian Q. F. field gun.
22. The Swiss Q. F. field gun.
23. The Mexican Q. F. field gun.
24. The United States Q. F. field gun in action, with its crew.
25. The United States Q. F. field gun; gun in position of full recoil, having just been fired; noncommissioned officer standing is chief of section in charge of gun.
26. The United States Q. F. field gun, same as previous picture, only taken from other flank, notice caisson of fifth section, unlimbered on the flank of battery.
27. 4.7-inch United States gun in action; notice the long recoil.
28. 4.7-inch gun, United States, in draft; notice the eight horses.
29. Same as previous picture, cannoneers dismounted.
30. 4.7-inch gun, United States, in action; picture taken at full recoil position.
31. Artillery on the march; 4.7-inch gun crossing a stream.
32. United States field gun.
33. 6-inch United States howitzer. Model of 1908.
34. 4.7-inch gun ready to fire; gunner looking through panoramic sight. No. 1 on right of piece wetting the quadrant.
35. 4.7-inch United States gun, firing position, taken from the front.
36. 4.7-inch rifle, United States.
37. 3.8 inch United States howitzer.
38. Howitzer battery in action.
39. Krupp, 28 centimeter, 11.2-inch howitzer.
40. Same as No. 39.
41. German artillery in action. Notice observation ladder to the front, officer on top.
42. German siege gun.
43. Sketch, 42 centimeter motor howitzer; the only information available, at this time, of this famous German gun.
44. A Krupp gun in the field, 4.7-inch.
45. A wheel girdle for 4.7-inch Krupp gun.
46. A British howitzer in action.
47. A heavy French field gun, 13.8-inch.
48. United States common steel shell and shrapnell, model 1905.
49. Types of shrapnel used by various nations.
50. United States common shell, common shrapnel, high explosive shrapnel.
51. United States field artillery range finder.
52. Test at Fort Sill of various types of B. C. instruments, observation telescope, etc.
53. Zeiss and ordnance B. C. instruments in test at Fort Sill.
54. Panoramic sight. Model of 1904.
55. Range quadrant.
56. Panoramic sight, peep sight, sight shank.
57. Recoil controlling mechanism; 3.2-inch United States Q. F. gun.

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