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JANUARY-MARCH, 1912

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CONTENTS

The Deport Field Gun	<i>Frontispiece.</i>
Field Service Exercises for a Battalion of Light Artillery.— Maj. G. Aubrat (Continued).....	7
Field Artillery Matériel of Great Field of Fire.—Lt. Col. A. Deport	53
New German Field Artillery Firing Regulations.....	73
Organization and Tactics of the Japanese Field Artillery.— Gen. Richter	79
The Problem of Clearing the Mask.—Lt. Sherman Miles	92
The Field Artillery of the United States Army.—Lt. Col. John E. McMahon	95
Sparta, 1911.—Capt. Robert H. Tyndall	109
New Russian Guns	112
The School of Fire for Field Artillery	116
"Gunnery and Explosives"	120
The Light Artillery Saber	120
Wanted—Translators	121
Diaries of Equitation Work at the Mounted Service School	122
Current Literature	129
Field Artillery Directory	140

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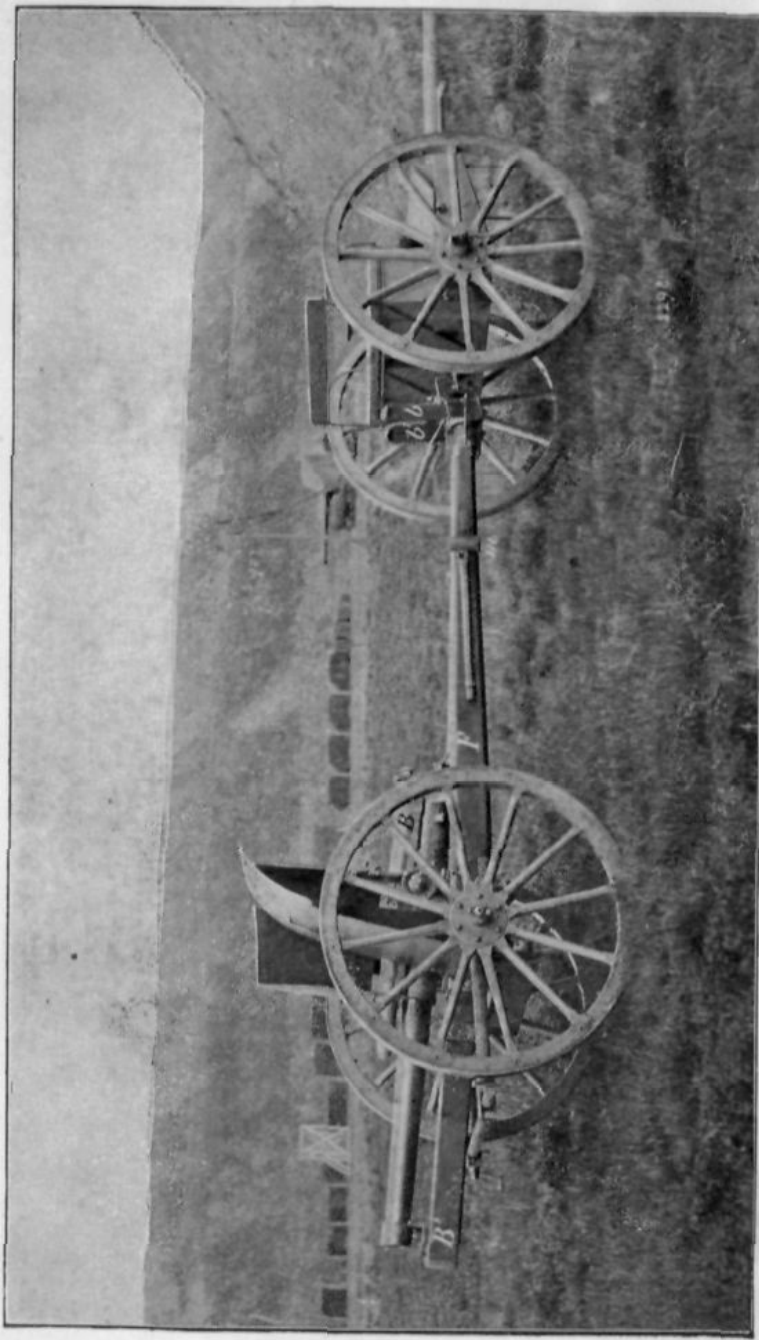
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The Deport Field Gun.

The Field Artillery Journal

Vol. II

JANUARY-MARCH, 1912

No. 1

FIELD SERVICE EXERCISES FOR A BATTALION OF LIGHT ARTILLERY

BY G. AUBRAT, MAJOR OF FIELD ARTILLERY.

BERGER-LEVRAULT & Co., PUBLISHERS, PARIS.

SECOND EDITION.

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(CONTINUED FROM DECEMBER NUMBER.)

FOURTH SERIES.

Reconnaissance and Occupation of Positions.

FIRST SESSION.

The battalion commander acts as director; assistants are detailed as follows:—from the 2d Battery—one lieutenant; one sergeant, one corporal and one trumpeter as scouts; one sergeant as agent of communication: from each of the other two batteries, one sergeant as agent of communication.

The batteries are represented by the following details:—1st Battery—one battery commander, assisted by one corporal and one trumpeter; two chiefs of platoon; four chiefs of section, each carrying his sight; one first sergeant; six privates, mounted, to act as horseholders and to represent the movements of the limbers: each of the other two batteries—one battery commander; two privates, mounted, with flags, to mark the head and tail, or right and left, of the battery.

The details assemble at 8 a. m. near Satory farm (see map, 1/80,000 Paris S. W.), and are formed up by batteries, with the scouts and agents on the right. The director then gives his instructions.

Part I. March of Approach.

Situation. The battalion is marching with the main body of a division. The advance guard battalion is in action. The division

commander calls for another battalion to reinforce it. The artillery commander sends the following order by an agent:

"C. O. Divisional Artillery to C. O. 2d Battalion.—Reconnaissance; let your batteries follow at once."

The battalion commander indicates the method of solving the problem, as follows:

"We will take the road, marching at a walk, and assuming that we are with an infantry column. The distance between the two battalions, according to the assumed order of march, would be about four kilometers; if the agent were sent back when the advance guard battalion moved into position, he would reach us in about ten minutes, when we should be between La Minière and Guyancourt

"We will assume that the agent, when he brings his message, says that the advance guard battalion is in position near Troux, about three kilometers to the front, and that there is a good road all the way."

The battalion commander forms the column with regulation distances, so as to make it occupy the road space of three firing batteries and marches thus to a point half way between La Minière and Guyancourt; here he calls the senior captain, and gives him the following orders:

"Captain A, I am going forward on reconnaissance, in the direction of Troux, which is about three kilometers distant. Take command of the column, and follow me at a trot."

He then directs the chief of scouts to mark the road, and leaves the column. The road being level, the batteries follow at an unbroken trot. As they approach Troux, the three battery commanders are called up for reconnaissance; they at once start to join the battalion commander, whom they find at the highest point on the road between Troux and St. Cyr.

The lieutenant at the head of the leading battery halts the column at the northwest corner of Le Plan woods (Fig. I'). The three battery commanders move off to the right (east) of the road, taking very wide intervals, and begin to reconnoiter their positions. The column remains on the road.

This terminates the first part of the exercise. The battalion commander assembles the officers for discussion, and gives his instructions for the next part.

Criticism by the battalion commander. "The march of approach was made at an even, unbroken trot. This was correct, the distance being only three kilometers.

"When the battery commanders started on reconnaissance, the lieutenant left in command showed no initiative. Instead of remaining in his regulation place, ten meters in front of the leading carriage, he should have felt free to leave the column entirely. When a lieutenant is placed in this position, it is necessary that he should find out, before the batteries come up, where the battalion and battery commanders are, and study the ground so as to make proper dispositions.

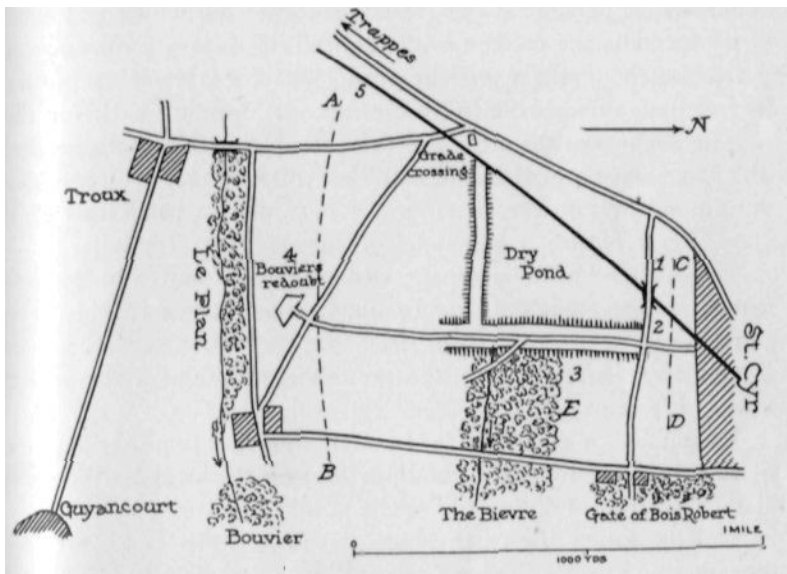


Fig. I.'

"This is the only possible way to get results in actual service. This will be evident if we review the course of the whole exercise.

"The artillery commander sends for the battalion commander. Since the latter, when he leaves his batteries, has no idea what his orders will be, all he can do is to leave orders for them to follow. When he sees that he is approaching the position, he leaves an agent on the road to bring up the battery commanders for reconnaissance.

"The battalion commander has three kilometers to go; this will take him at least ten minutes. The column will cover the distance in fifteen minutes, so he has at most a start of five minutes. When he reaches the position, he has still to find the artillery commander and receives his orders, which will take probably five minutes, so that the batteries will be waiting in rear of the position by the time

he is ready to give his first orders. Both he and the battery commanders will then have to reconnoiter the position.

"The lieutenant, then, will have plenty of time. Instead of passively waiting for orders, he should do all in his power to facilitate getting the guns into action. In this particular case, there are a number of things that the lieutenant in command of the column might have done. Let us suppose that, on leaving Troux, he gallops ahead. Reaching the northwest corner of the woods, he sees the reconnaissance parties on the road. Not knowing which way they will go, he halts the column with its head opposite a crossing over the road ditch on the right; he then looks for a crossing on the left, and finds one some fifty meters ahead. Sending back for the senior lieutenants of the other two batteries, he looks over the ground with them, and notes that the batteries will be perfectly concealed from the enemy's observers, anywhere near the road on either side.

"When the battery commanders commence to reconnoiter positions on the right, each lieutenant, without orders, moves his battery off the road and halts it 300 or 400 meters in rear of his own captain."

Description of the ground. Before taking up the next part of the exercise, it will be well to describe the ground to be used.

It is bounded on the north by St. Cyr (Fig. I'); on the south by the Bièvre between Troux and Bouviers; on the west by the road and railway from Trappes to St. Cyr; and on the east by the road and wall extending from St. Cyr to the Porte de Bois Robert and Bouviers.

The two arms of the Bièvre cross this area, running from west to east. The line AB marks the crest between the two. South of this line the ground slopes sharply, and artillery can be placed with mounted defilade against any probable hostile artillery position south of St. Cyr. North of the crest a more gradual slope runs down to an embankment along the edge of a dried-up pond, and the woods bordering the north branch of the Bièvre. Another embankment, running north and south, separates the bed of the pond from the woods; its height is about 4 meters, and its breadth 50 meters.

The south side of St. Cyr lies a little behind the crest line CD. This crest is not very distinct, and its precise location is not important to the artillery assisting in the defense of St. Cyr against an attack from Troux or Bouviers; the positions are determined by the minor accidents of the ground. The best ones are behind the road from the Porte de Bois Robert, which runs along a high embankment

near the railway, and north of the woods E (1, 2 and 3, Fig. I').

To complete the picture, imagine an observer looking north from the point 4, Fig. I', just west of the Bouviers redoubt. This redoubt is here treated, not as a fortification, but as an obstacle—a wood impassable for artillery, for example.

The observer will see (Fig. J'), behind a line of large trees, the railway bridge and the houses in the south part of St. Cyr; the trees are on the embankment running east and west. St. Cyr is visible also directly in prolongation of the north and south road and embankment.

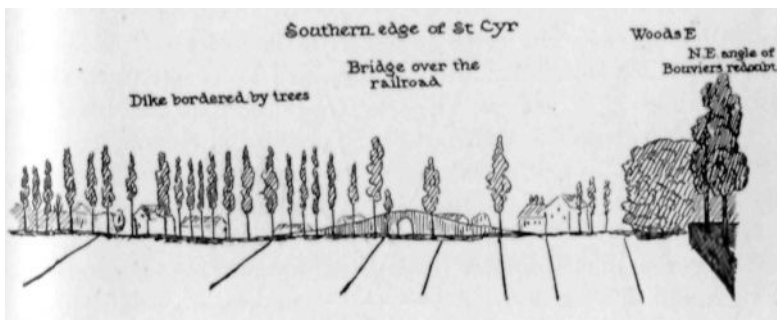


Fig. J.'

Part 2. Occupation of Position and Fire by Battalion.

The director states the new problem as follows:

"We will now assume that the battalion has come from the direction of Trappes. This leaves the march of approach that we have just made unconnected with the present problem, but that is immaterial as far as instruction goes. It was done in this way to save time.

"*Situation.* Our infantry and our first battalion are under shrapnel fire. Gun flashes and troop movements have been seen this side of St. Cyr, indicating that the enemy has several batteries in position there. Our first battalion, which was with the advance guard, is in action behind this crest, its left on the railway and its right 250 meters west of the road. Its target is the hostile artillery. We represent the second battalion, from the main body.

"The enemy's infantry is under cover, in rear of the long line of trees and in the edge of the woods. Our skirmish line is along the crest AB, its left on the railway, and its right in front of Bouviers; the reserve is in Le Plan woods.

"We will assume that I receive these orders from the commander of the divisional artillery:

"The enemy has artillery in front of St. Cyr on a front of 450 mls. You will come into action against that part of the line to your left of the bridge; on account of the woods (E, Fig. K') the two battalions are to cross their fire. Your position is east of the road I have looked over the ground, and find that you can get at least mounted defilade against the enemy's artillery; take flash defilade you can.'

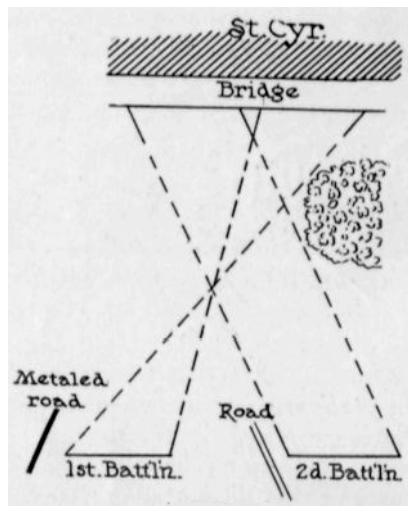


Fig. K.'

"You may return to your batteries, and explain the situation to them; we will then take up the solution of the problem."

Solution. The director gives the following orders.

To Lieutenant A, who is acting as adjutant: "The battalion is to take position on the right of the road, to fire upon the enemy artillery in front of St. Cyr and to the left of the bridge. Nothing can now be seen of the hostile artillery; but it has been firing, for the flashes have been seen, and it must still be there. Find some place from which you can locate the enemy's guns and observe our fire.

To the battery commanders: "Our target is that part of the enemy's artillery to the left of the bridge; its front is about 210

mils. Each of you will cover 70 mils front. Take as your initial data: corrector 18, range 2,000, angle of site 0.*

"The position is on the right of the road, with flash defilade against the enemy's guns if possible. The order of the batteries will be 1st, 2d, and 3d, from right to left; interval between batteries, 150 or 200 meters. It may be that the enemy's observers in the trees or houses, or on the bridge, will see the batteries as they come into position; so make all your preparations beforehand, then bring all the batteries in at once and open fire quickly."

Action of Lieutenant A. On receiving his orders, given above, the lieutenant looks for an elevated post of observation; he selects a tall tree in Le Plan woods, behind the batteries. As he starts to climb this tree he receives a note from the director, telling him to assume that he can see a line of artillery just behind and to the left of the bridge, extending as far as the main road to Trappes. He at once sends the following verbal message to the battalion commander:

"Just behind and to the left of the bridge, a line of artillery; front 200 mils."

Action of the batteries. We will follow out the action of the 1st Battery only, since the others, having only a few men, can do no more than simulate their maneuvers.

The battery commander posts his trumpeter to mark the place where he wishes the battery to halt, and then sends the following order to the lieutenant in charge of the battery:

"Bring up the battery, in line, to the place indicated by the trumpeter. Chiefs of platoon and gunners report to me."

The chiefs of platoon and gunners being assembled, the captain gives the following instructions:

"The battery is going into position of observation here, preparing to fire upon artillery on a front of 70 mils, measuring to our left

* *Graduation of the French laying instruments.* The sight (collimator) can be turned through a complete circle, but the graduation is separate in each quadrant, 1600 being the highest reading. The least reading on the limb is 200 mils; smaller angles are measured on the micrometer. The two readings are given separately in all commands; "deflection 840" would be given as "limb 8, micrometer 40"; "deflection 725," as "limb 6, micrometer 125," When the line of sight is parallel to the axis of the piece, the reading is not zero, but "limb 0, micrometer 100." The angle of site scale reads zero when gun and target are on the same level. The normal corrector setting is 20.—*Translator.*

from the bridge. The distribution difference will be 15 mils; right gun will be directed upon the bridge, and the sheaf formed laying the others on it. The whole battalion is to come into position at once, at a trot, on signal of the battalion commander; the gunners will mark the positions for their pieces, and the battery will come in double section.

"Fire is to be opened as soon as possible after coming into position. I will give the gunners all their instructions here; chiefs of platoon rejoin the battery and await the battalion command signal."

The battery commander now posts the gunner of the first section at the point where his piece is to be. Standing beside him, he looks for an aiming point nearly in line with the target. Finding a milestone about 200 meters to the front, and half a finger-breadth, or 15 mils, to the right of the target, he gives this to the gunner as an aiming point, directing him to lay on it with "limb 0, micrometer 115" as soon as his piece is in position. To get the other guns in the proper direction, he instructs the gunners to lay parallel to the first piece, by sighting upon its collimator standard with the proper deflection setting; then to find an aiming point, read and record its deflection, and open the sheaf by adding the prescribed deflection difference.

When the chiefs of platoon rejoin the battery they give the same commands as if the guns were actually present; all the men prepare to simulate the occupation of the position. At the battalion commander's signal, all move forward; each chief of section halts beside his gunner and sets up his sight. The first sergeant takes charge of the horseholders and led horses, and simulates the movement of the limbers. The captain gives the commands: "Angle of site 0; corrector 17."

The battery being in position, the battalion commander says to the captain:

"Shrapnel fire is opened from St. Cyr upon our skirmishers; you see gun flashes in your sector of observation, about a finger-breadth to the left of the bridge."

The captain commands: "Add 20; anchor;* by battery from the right; corrector 17; range 2000." He then simulates fire for adjustment

* To make the French gun stable in its firing position, it is necessary "anchor" it by means of wheel shoes. This operation takes a little time and some labor; and it is necessary to "cast loose" before the trail can be shifted to change target.—*Translator.*

upon the crest. At the fourth salvo, his distribution and corrector being adjusted, the battalion commander tells him that the enemy has ceased firing. The captain determines the range to the crest, using one piece and percussion fire, and then registers the ground behind it. This being completed, the battalion commander assembles all the officers, and says:

"We will now assume that the action has continued for some time and that the second battalion has silenced the hostile batteries to the left of the bridge. But conditions are suddenly changed; every time the battalion fires, it receives so heavy a fire in return that the cannoneers have to take cover. The enemy's guns can not be located.

"Lieutenant B, you will consider yourself to be one of my staff officers. Your orders are to locate the guns that are firing upon us."

When Lieutenant B has left the party, the battalion commander says to one of the captains:

"Captain B, I am assuming that the fire is from a battery east of the embankment, behind the woods (Fig. I', 3). Go with Lieutenant B, and give him such information as he would actually get in service."

When Lieutenant B has completed his reconnaissance and made his report, the battalion commander takes up the discussion of the exercise, as follows:

"I have no criticisms to make on the occupation of position or on the conduct of fire.

"Lieutenant B was at first at a loss to find a place from which he could locate the enemy's guns. Finally he went to the road to Trappes (5, Fig. I'). Captain B then told him that he could make out a battery behind the woods (E, Fig. L'), partly concealed by the embankment. Lieutenant B at once came back with this information.

"Here he was wrong. The information could have been sent just as well by a scout; if necessary, a rough sketch like the one we have just made (Fig. L') might have been sent. The lieutenant could then have remained in observation; he should have remembered that the target being entirely concealed from the battery commander, he would be needed to observe the fire."

The battery commander is then asked how he would conduct the fire if his battery, in position near the railway (A, Fig. I') were ordered to fire upon the battery concealed behind the woods. It is found that the only satisfactory solution is to range on the northwest corner of the woods with one piece, and then methodically sweep

the ground in rear. Fire would be thus opened every time the hostile battery fired upon our second battalion, or every time that battery fired upon the hostile batteries near the bridge. The fire would be observed from an auxiliary station at a distance from the battery

Part 3. Preparation of Attack; Breaching a Wall.

"*Situation.* The artillery duel is still indecisive; first one side gains the advantage, then the other. The positions of the infantry are as before; our infantry has tried several times to get possession of the embankment and of the woods E, but without success.

"Reinforcements have now come up; a brigade, assembled at Bouviers, is about to renew the attack upon the woods. The Battery is ordered to support it.

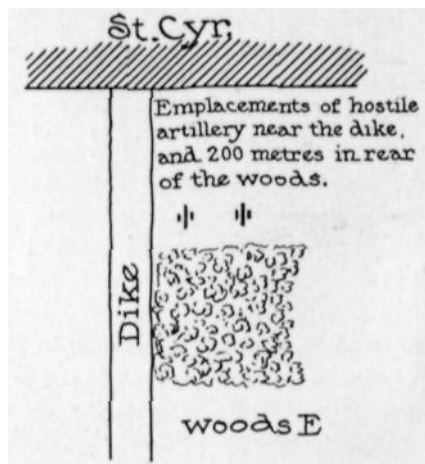


Fig. L'.

"Captain A, your orders are to report at once with your battery to the general commanding this brigade, at Bouviers."

Captain A at once goes to Bouviers, having his scouts mark the route. The battery follows, moving along the edge of Le Plan woods, where it is entirely concealed from the enemy. The director and all the other officers go direct to Bouviers, where the director as the brigade commander, gives Captain A the following order.

"Take position to fire upon the edge of those woods, and make them untenable. I am going to attack with a regiment.

"The skirmish lines are now about 600 meters apart; those of the enemy are in front of the woods; ours are lying down on the forward slope, 400 or 500 meters in front of Bouviers."

Captain A at first reconnoiters a position west of Bouviers, but abandons it in favor of another to the east. Here he puts the battery in position at a trot, with the pieces just concealed, and opens fire at once, sweeping the ground on both sides of the probable line of attack.

To cover a broad front, he takes a distribution difference of 25 mils, which, at 1000 meters, gives each gun 25 meters, or about the breadth of the cone of dispersion. He then divides his ground into three sectors of 80 mils each, the axis of the center one being on the probable line of attack. He sweeps each of these sectors separately, and then repeats. When the director informs him that the infantry is getting so close that his time fire is dangerous to them, he passes to percussion fire; a little later, he increases his range 100 meters, then 200, then 300, and finally resumes time fire.

Comments of the director. "I agree with Captain A in his selection of position and his method of occupying it. When his battery is once in position, it is concealed from both the enemy's infantry and artillery, and its only danger is from wild shots intended for the infantry.

"Thorough preparation having been made beforehand, the battery came into position at a trot, in sight of the enemy's infantry at 1000 meters range. The ground being open, this was the best solution; the teams would be visible for only a few seconds, and, even if some of the horses should be hit, they could still keep up long enough to get the guns into action. Captain A rightly rejected the idea of coming into position slowly, dismounted, in full view of the infantry preparing to advance.

"Fire was adjusted, not on the edge of the woods, but on the little ridge some 50 meters this side, which hides the foot of the trees. Progressive fire was not used, as it was necessary only to cover the ground in front of the woods. When the time fire became dangerous to our infantry he changed to percussion fire, then increased his range, and finally took up time fire again at a still longer range, continuing this until the infantry had gotten well into the woods.

"I have no criticism to make on any of these things, but I cannot agree with Captain A as to the distribution of his fire. The method he adopted is complicated, and, I believe, could not be worked at this close range, 1000 meters from the hostile infantry. The battery

has constantly to change target, and even so covers only 240 mils front, which amounts to only 240 meters at this range.

"The men cannot be expected to cast loose and reanchor every few minutes to change target; the enemy's infantry is at short range and, although it will not be devoting much attention to the artillery a great many of its shots will reach the battery. This will necessitate firing without anchoring the guns; hence they will not remain in place, but will have to be run up and relaid for every shot, like the old guns. This being so, the captain will have to follow to the letter the rule given in par. 677 of the Drill Regulations:

"It is a normal procedure to fire over the heads of friendly troops; but the projectiles must not come near enough to annoy them. Artillery should not fire when the infantry is within 500 meters in front of the guns; and when it arrives within 500 meters of the enemy the range should be increased.'

"In this case, if the rule is strictly observed, the battery can hardly fire at all. What, then, is to be done? Before giving my own solution, I will review the situation.

"Our infantry is trying to advance, but is prevented by the fire of the hostile infantry in the woods. The battery must fire upon this infantry, keep the men lying close, and prevent them from firing effectively. To be of any use, it must cover a broad front; artillery fire on a front of 80 meters will not materially affect the volume of fire delivered by a long infantry line. When our infantry has come within 500 meters, the artillery must cover a front of at least 400 or 500 meters.

"The 75-mm. gun, anchored, and using the full extent of its traverse on the carriage, covers a front of 104 mils; and a single shrapnel burst covers a front of 25 meters, or, at 1000 meters, 25 mils. Hence a single piece can, without shifting the trail, cover completely a front of 100 meters at this range, firing four rounds with a change in direction of 25 mils, or 12 turns of the traversing wheel, after each one. Theoretically, then, a battery, using a distribution difference of 100 mils, can cover 400 meters front; practically, it cannot do so much, for, when the sheaf is formed and the guns anchored, they will never all be at the center of their traverse, and there will be gaps in the 400 meters front.

"The solution that I would propose for this problem is as follows:

"The captain makes a rapid reconnaissance, puts the battery under cover near the position, assembles his officers and non-commissioned officers, and explains to them in detail all that he is going to do

The maneuver must be so thoroughly understood that it can all be executed without further command from him, if it is to succeed.

"Captain A actually did proceed in this manner; but instead of the instructions that he gave for firing, I should have given these:

"As soon as the battery is in position, we will adjust quickly on the edge of the woods, and keep down the fire from there. In order to cover a broad front, take a distribution difference of 100 mils, the right gun being directed on that tall oak, which will be the aiming point for all guns. Initial firing data: deflection, No 1, limb 0 micrometer 100; No. 2, limb 0 micrometer 200; No. 3, limb 2 micrometer 100; No. 4, limb 2 micrometer 200; angle of site 0; corrector 17. When we get the 100 meter bracket, chiefs of platoon will complete the adjustment, and get a 50 meter bracket on that little crest that masks the foot of the trees; they will also register the ground just this side of it, to determine the point where our infantry will begin to be in danger from the fire. Fire for effect will be taken up at my order, each piece firing independently at the rate I may prescribe, using four-round volleys and sweeping by twelve turns of the wheel.'

"This solution may seem to be no better than Captain A's; but the difference is that here the pieces are anchored, and the ground over which the infantry is to advance is registered; hence fire may be kept up until the infantry has come within 200 or 300 meters of the enemy.

"The minimum distance of 500 meters, mentioned in the Regulations, is a survival from the time of the old gun. Then the piece recoiled at each shot; the cannoneers had to run it up by hand, and the gunner had to relay with his open sights, as with an infantry rifle. As the infantry approached the hostile position, and the battery accelerated its fire, the cannoneers became exhausted from constantly running up the gun; the target became masked by the smoke; thus the laying grew more and more inaccurate. To avoid danger to the attacking infantry, the battery had to divert its fire when the 500 meter line was reached. This would be the case today, if Captain A's solution were adopted, and the pieces not anchored.

"But in the other solution, the guns are anchored. The gunner, sitting on his seat behind the shield, has only to keep the bubble of the level centered and the collimator on the aiming point. And experience has shown us that even if he does not touch the laying gear for several shots, there is no material error in range or direction. It makes but little difference, then, if the cannoneers become

excited as the crisis approaches, when the battery has to fire rapidly and the target becomes indistinct; the fire continues fairly accurated

"It seems, then, that we are justified in giving a liberal interpretation to the paragraph of the regulations just cited. The ground in front of the enemy's position has been registered; the battery commander and his chiefs of platoon can watch the progress of the infantry and continue the fire until it reaches some registered point near the target,—for instance, the edge of that field of alfalfa."

Situation No. 2. "Our infantry occupies the woods; the enemy is in full retreat, and his artillery is silent. The brigade commander has gone to the front, leaving no orders for the battery.

"Captain A, take such action as you think necessary."

Captain A leaves orders for the battery to limber up and follow him, and moves forward to look for the general, having his scouts mark his route. The rest of the party goes directly to the northwest corner of the woods E; and when Captain A comes up, the director, as brigade commander, gives him the following orders:

"The enemy has formed a strong infantry rear guard, which has taken position behind the wall of Bois Robert, and checked our pursuit. Get your battery up as soon as you can, and demolish the wall."

Captain A sends for the battery, and places it in position on the embankment, as if to fire in the direction of St. Cyr, the line of guns a little south of the north edge of the woods; he then commands, "report for firing data." The officers, chiefs of section and gunners being assembled at the corner of the woods, he gives the following instructions:

"Target, the wall to the east; range, 600; angle of site, minus 5. The battery will change front forward on the right piece, moving by hand. The first section will move first, and take position just clear of the woods; then the second and third, all the cannoneers of the battery helping; finally the fourth. Meanwhile I will adjust the fire with the right piece, and all will take up the fire when in place."

The change of front and the fire are simulated. The director approves the whole procedure.

Summary.

Before dismissing the party, the director sums up the day's operations as follows:

"We have illustrated four different operations today: approaching a position and marking the route; coming into position and preparing

fire, then firing upon artillery in observation; occupying a position in observation, locating targets, and conducting fire; and finally, preparing an infantry attack and breaching a wall. The most important lessons to be learned are these.

"March of approach. When a battalion commander leaves his batteries on reconnaissance, he cannot give them any very complete or definite orders. He knows only in a general way where he is going, and he has no idea what he is to do there. All he can tell the officer left in command is to follow him.

"The batteries will generally approach the positions before he can give them their final orders, and it is then the duty of the captains, or of the lieutenants if the captains are absent on reconnaissance, to take, on their own initiative, such action as the circumstances may require. Thus, they should keep the batteries out of sight, and bring them as near as possible to their probable positions, reconnoitering lines of march into and out of the positions, etc.

"In coming into position it is often necessary to choose one of two methods: coming in rapidly at a trot, or slowly, with drivers dismounted, placing the guns by hand. The first method reduces to a minimum the time required before firing the first shot, but may be dangerous if hostile artillery is in observation and has registered the ground. The second method makes it easier to keep out of sight of the enemy's observers and scouts, but the battery is more unwieldy, and may easily be thrown into confusion by chance shots. In this connection, you may remember the plan followed in putting the battery into position to fire upon the wall at Bois-Robert.

"Observation. An officer sent out to locate a target should not consider his work done, and leave his observation station, when he has found the enemy. He should remember that it is generally necessary to have an auxiliary observer when firing upon a masked target.

"Firing. It would be well to remember the manner of preparing and conducting the fire upon the enemy's artillery, and also that upon the enemy's infantry when the intention was to protect our skirmishes from rifle fire as long as possible."

SECOND, THIRD, FOURTH AND FIFTH SESSIONS.

The following reports deal with a series of exercises which took place west of Versailles, between the Forest of Marly and St. Cyr. We will give first a description of the ground, and then a brief account of each exercise. Each account will include a statement of the preliminary arrangements for the exercise, and the various situations

announced by the director; solutions will sometimes be given, but no discussions. In the field, a few words will generally suffice to explain a solution, where a long written discussion would be necessary.

Description of the Ground.

The ground selected differs from that hitherto used, in that it is somewhat broken. A complete description would be long and complicated. In order not to weary the reader, a general description will be given, followed by reference to such details only as are necessary to an understanding of the problems. As the Gally Brook is all the exercises, the dividing line between the two parties, description of the ground on each side of it is given separately.

The ground in question is a rectangle about six kilometers long two wide (Fig. M'). It is bounded on the north by the Forest Marly; on the south by St. Cyr and the Gazé woods; on the east by Marly—Grille de Maintenon—Gally—St. Cyr road; on the west the Bailly—Pontaly—Fontenay le Fleury—Les Missionnaires road.

For an observer placed about in the center of the rectangle, on the Pontaly ridge, the view is limited to the north and south by the two plateaus, which rise to an altitude of some 160 meters. The Marly plateau is heavily wooded, and has no view; the portion of other plateau which lies west of St. Cyr is more open, and overlooks all the ground to the north. At first sight the ground between seems to consist of a confused series of ridges, running in all directions; but a little study of the course of the streams brings order out of the apparent chaos.

One system of streams comes from the Forest of Marly, and runs from north to south. Another comes from Satory and Gazé woods, and runs from south to north. All flow into the Gally Brook, which runs from east to west across the middle of the area.

The bottom of Fig. M' is a profile which gives a general idea of this ground. It will be noted that at each end there is a nearly level line at altitude 160; in front of these the ground is wooded and steeply sloping; then comes a series of undulations, and across the middle runs a ridge at elevation 120.

North section. That part of the ground north of the Gally Brook consists of three principal ridges. The first runs east and west between Gally and Rocquencourt Brooks. Pontaly farm is near its western end, and the Faisanderie park on its southwest slope. We will call this the Pontaly ridge.

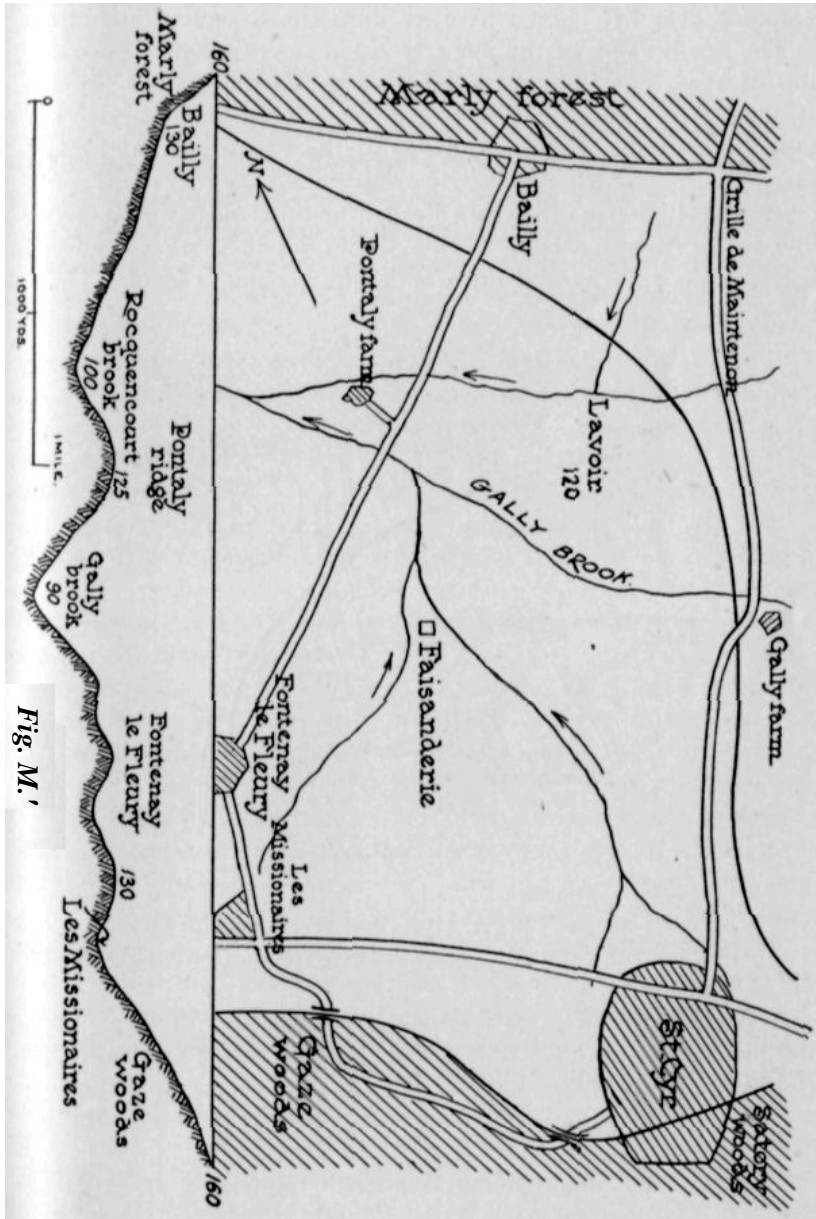


Fig. M.

The other two run north and south, perpendicular to the first. They are separated by the Lavoire Brook, so called from the laundry (*lavoire*) near the point where it joins the Rocquencourt Brook.

The north slope of the Pontaly ridge slopes about 1 on 25. The top of the ridge is about 20 meters above the bed of the Lavoire Brook. Any desired degree of defilade may be taken here. On the other side of the stream the slope of the two northern ridges is at first about 1 on 25, but

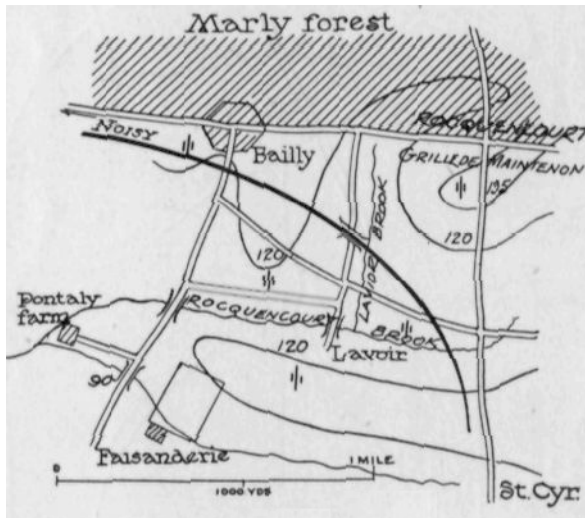


Fig. N.'

becomes gradually gentler; one of the reaches its highest point about Baillly, the other near the St. Cyr road 200 meters south of the Grille de Maintenon. West of Baillly, between the railway and the woods, the ground is level. The crest which extends across the St. Cyr road south of the Grille de Maintenon is very marked, and gives at least mounted defilade against the heights of St. Cyr.

Artillery can move across country anywhere, except that the streams can be crossed only in certain places. The Pontaly ridge can be reached only by Lavoire and Pontaly bridges; and the railway can be crossed only at the two grade crossings, or under the bridge between them.

There are two main north and south roads, one from Marly to St. Cyr, the other from Baillly to Pontaly. Between them is a dirt road, passing under the railway, and running south only as far as

the Lavoir bridge. Three roads run approximately east and west; the main Rocquencourt—Bailly—Noisy road; the one parallel to the

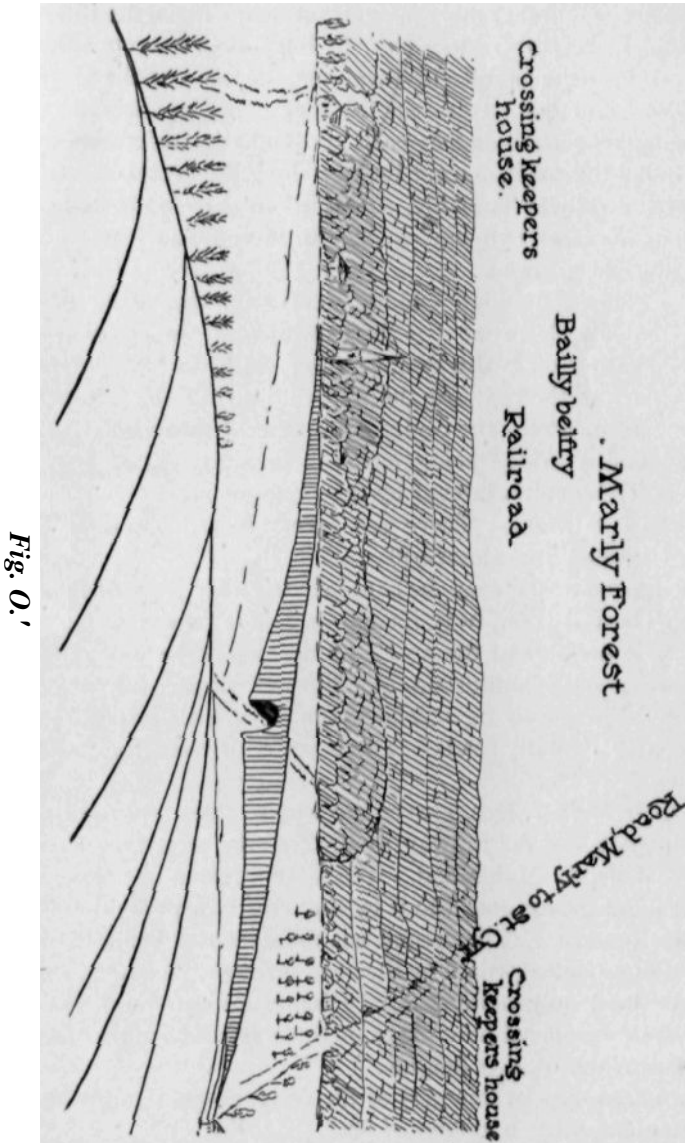


Fig. O.

railway, connecting the two grade crossings; and the one at the foot of the slope, along the brook between the Lavoir and Pontaly bridges.

The forest of Marly is surrounded by a high wall. The only openings through this are at the Grille de Maintenon and at Noisy.

Standing on the Pontaly ridge and looking north, the artillery commander sees the view shown in Fig. O'. The convexity of the slope conceals the brook; he sees only the tops of the trees to the left front. Farther on he sees the long curve of the railway, with a crossing-keeper's house at each end and the bridge nearly in the center. All the roads, except the one along the brook, can be traced. Beyond the railway is Bailly, so buried in the woods that only the church tower and two houses can be seen. The forest of Marly forms the background.

Fig. P' shows the view looking south from the Grille de Maintenon. Immediately in front is the railway, and the crossing-keeper's house. Farther on is the Pontaly ridge, with the walls of the Faisanderie park to the right, on the south slope. To the left is St. Cyr; and beyond it, across the center, is another railway line, part of the roadbed and a bridge being visible. To the right is Fontenay le Fleury. The view is limited by the Gaze woods.

Artillery positions. There are several possible positions in the tract of ground just described.

Any desired defilade can be obtained on either slope of the Pontaly ridge. There is room here for ten or twelve batteries.

On the other side of the brook, on the two north and south ridges, there are good positions on the forward slope, with any desired defilade. These can be reached with very little exposure, by the Lavoisier and Pontaly roads. There is room here for at least ten batteries.

On these same ridges, nearer the woods, there are positions west of Bailly, north of the railway, and behind the crest 200 meters south of the Grille de Maintenon. The first position is masked by an orchard, and the approach to it by the trees of a park; there is room for three batteries. The second has the defect of being immediately in front of a defile, formed by the road through the woods, and hence could be used only under special circumstances. Four or five batteries could be placed here, three of them at least with mounted defilade against the St. Cyr heights.

South section. In this part of the rectangle there are three excellent positions for a battalion of artillery. (Fig. Q').

The first is west of St. Cyr, at the edge of the plateau; it is reached by a narrow road, partly in the woods, running parallel to the railway. The altitude of the position is 160 meters, and the view is very

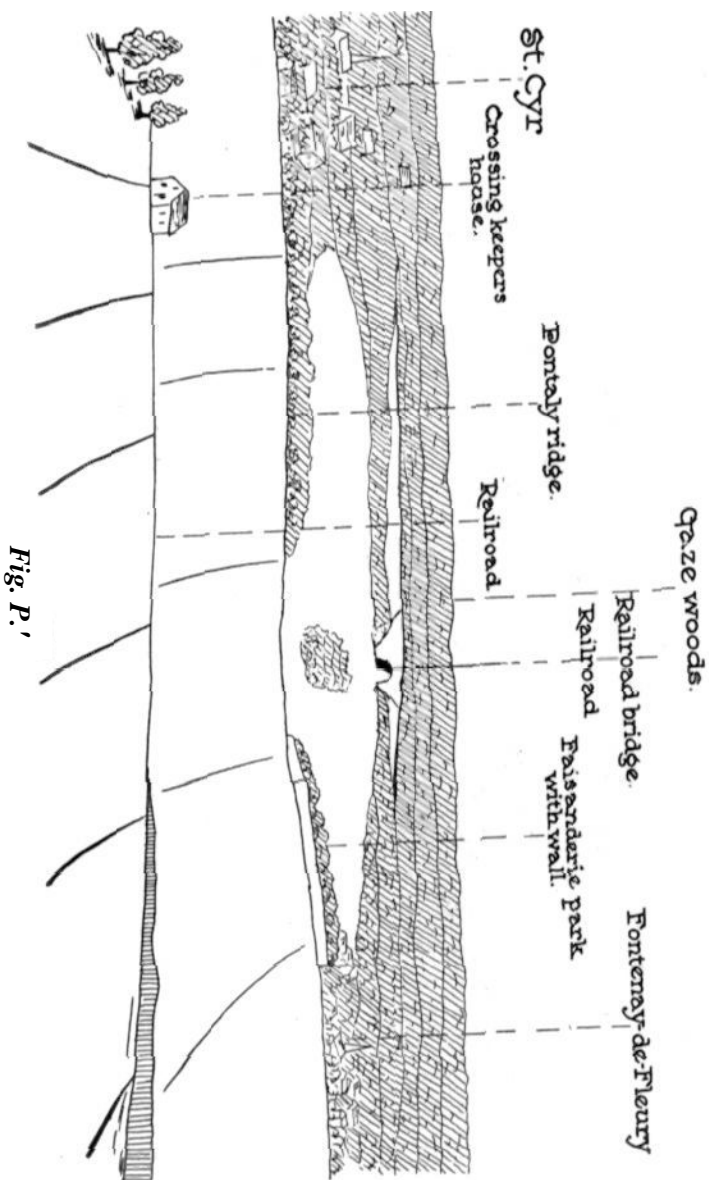


Fig. P.

extended. The second is at Les Missionnaires; and the third south of the road from St. Cyr cemetery to Fontenay le Fleury. The second and third positions are 600 or 800 meters north of the first, and about 30 meters lower.

The shortest way from the first to the second is by a very bad road; it is sandy, and, while it would be easy enough to go down, it would be very hard to come up. Besides, as Fig. P' shows, a considerable part of it is in view of the enemy; the railway bridge, under which it passes, is very conspicuous.

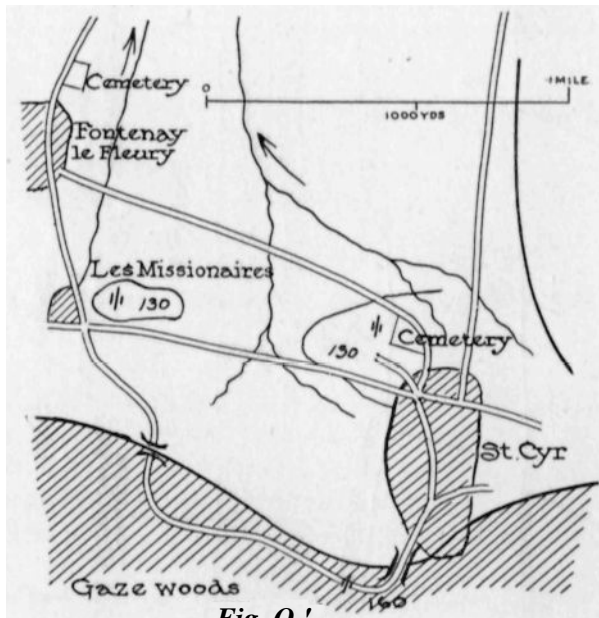


Fig. O.'

There are several roads from the first position to the third, passing through St. Cyr, with perfect concealment. These roads can also be used, in connection with the one from Fontenay le Fleury to St. Cyr, between the first and second positions.

Discussion of positions. It will be noted that, in an action on this ground, one side can use concealed positions on the front slope, some of them even offering flash defilade; the other side can use two tiers of fire. All the positions mentioned are chosen for counter-batteries, intended to fire on the enemy's artillery; there are many others which are suitable for single batteries told off as infantry

batteries, to fire upon the hostile infantry or accompany an attack.

It will be interesting to inquire how the Pontaly ridge and the positions on the front slope of the northern ridges can be used, to fire upon the positions at St. Cyr, Les Missionnaires and Gazé woods; and more especially to see whether covered positions can be found here to fire upon the elevated position and one of the lower ones, without moving the guns.

Let us consider the profile shown in Fig. R'. For convenience, round numbers have been used, and the line BCD taken as horizontal, which is approximately correct. A is the Gazé wood position; B, St. Cyr and Les Missionnaires; C, Pontaly ridge; DE, the front slope.

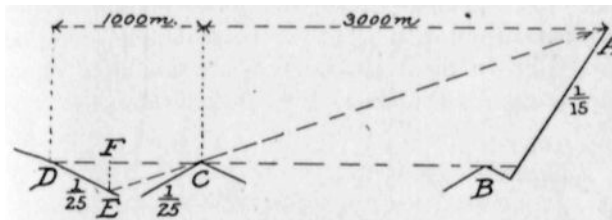


Fig. R.'

The slope behind the crest C being 1 on 25, the line of dismounted defilade (1.50 meters) against B will be 37.50 meters back; that of flash defilade (3 meters) will be twice as far. But as against C we get only 0.75 meters defilade for each 25 meters behind the crest; therefore the two lines of defilade will in this case be, respectively, 50 and 100 meters back.

The point E, where the line AC pierces the ground, is 200 meters in front of and 8 meters below D. This appears from the equations

$$DF = 25 EF \qquad CF = 100 EF$$

$$DF + CF = 125 EF = 1000 \text{ meters.}$$

$$EF = 1000/125 = 8 \text{ meters.}$$

$$DF = 25 EF + 200 \text{ meters; and since DF and EF are sensibly equal,}$$

$$DE = 200 \text{ meters.}$$

At a point 25 meters in front of E, the defilade against A is 1.25 meters; the lines of dismounted and flash defilade are at 30 and 60 meters respectively from E.

The next question is, whether guns placed with a given defilade against A, in either of the two positions just considered, can fire

over the crest. The condition for this is, that the angle of elevation of that point in the trajectory whose abscissa is equal to the distance to the mask must be greater than the angle of site of the top of the mask.

According to Captain Challéat's formula, the angle of elevation of any point of the trajectory is, in mils

$$2.5 (d - d') \pm c,$$

d and d' being the abscissae in hectometers of the target and the selected point respectively, and e the angle of site of the target. We will apply this formula to the two cases considered.

1. The gun is on the forward slope. We will assume 2200 meters as the value of $d - d'$, corresponding to a point of fall a few hundred meters in front of the target. Let A_p be the angle of elevation of the required point in the trajectory, A_t the angle of site of target target, and A_m that of the mask. Then

$$A_t = \quad = 3.7$$

$$A_m = \quad = 14.8$$

$$A^p = 2.5 \times 22 + 3.7 = 58.7$$

A_p being greater than A_m , the projectile will clear the mask.

2. The gun is on the line of flash defilade behind the crest C. The equations now become

$$A_t = \quad = 1.7$$

$$A_m = \quad = 40$$

$$A_p = 2.5 \times 22 + 1.7 = 56.7$$

A_p is again greater than A_m , and the fire is possible.

Hence a battery may be placed in either position—on the front slope of the northern ridge, or behind crest C—with flash defilade against Gaze woods, and still fire upon St. Cyr and Les Missionnaires.

It may be interesting to inquire what are the limiting values of the different quantities involved, permitting such fire from these positions. By equating A_p and A_m we find that the projectiles will clear the mask unless the slope of the ground behind C is greater than 1 on 17, or B is 38 meters lower than C.

In selecting positions with high defilade, battery commanders will frequently have to consider whether or not their projectiles will clear the mask. Since they cannot, in the time usually available for reconnaissance, make complicated calculations of angles of site, they must learn to solve the problem by estimation; but the only way to acquire skill in this is to solve many such problems deliberately. Of course, in case of actual firing, the estimate should always be verified by looking through the bore of the gun.

To sum up, we may say that there are positions behind the Pontaly ridge and on the front slope north of it, concealed from observers in the Gazé woods, and suitable for fire upon targets there, or in the lower positions at St. Cyr and Les Missionnaires. If the front slope position is selected, the battery commanders must observe their fire from stations about 300 meters in rear of the guns, so as to see over Pontaly ridge. In this case, they must send their orders by whatever means are available,—telephone, signals, voice relays, or placards.

General Plan of Exercises.

The battalion is to execute four exercises without matériel, between St. Cyr and the Forest of Marly.

The major will act as director throughout; he will have one lieutenant as assistant. Each battery will detail one non-commissioned officer and one private, mounted, to report to him, to carry messages, outline the enemy, etc. Battery commanders in turn will act as battalion commander, and will have the regulation number of scouts and agents.

The battery of the captain acting as battalion commander will be represented by a non-commissioned officer and two privates, to mark the space occupied by the battery. The other two batteries will be made up as follows: one battery commander, one corporal and one trumpeter, two chiefs of platoon, four chiefs of section carrying their sights, one first sergeant, and six mounted privates; the latter are for horse holders, and to indicate the movements of the limbers.

The lieutenant acting as assistant to the director, and all the scouts, will come from the battery of the captain acting as battalion commander.

Exercise No. 1.

Detail. Captain——(1st Battery), battalion commander.
 Lieutenant——(1st Battery), assistant to director.
 Lieutenant——(1st Battery), battalion adjutant.

Assembly. Intersection of Rocquencourt—Noisy and Marly—St. Cyr roads, 9 a. m.

General Situation. The battalion forms part of a Red advance guard, marching from Marly upon St. Cyr, with orders to pushback the rear guard of a Blue force marching on the same road.

The general situation is given out to the whole party at the assembly point. All then move to the crest crossing the road 200 meters south of the Grille de Maintenon, from which the panorama P' was taken, and the director gives out the first special situation.

Special Situation No. 1. At 9 o'clock the commander of the advance guard and his artillery commander arrive here. The point of the advance guard is stopped at the railway by infantry fire from behind the Pontaly ridge. Information received from the cavalry seems to indicate that the enemy holds the whole ridge, and also the Faisanderie park. The advance guard commander decides to attack.

He directs the colonel of the 1st Infantry to advance his regiment and drive the enemy from the ridge and park; he indicates the park as his first objective, and points out that the railway seems to give the opportunity to reach the enemy's left unobserved. He adds that one battery will be assigned to him.

The artillery commander receives the following orders:

"Send one of your batteries to report to the colonel of the 1st Infantry. Place your other two batteries where they can open fire without delay; but do not get into such a position as to draw the enemy's fire upon this road, by which we have to come out of the woods."

When this order is received, the batteries are a kilometer behind in the woods.

The party goes back into the woods, and forms up on the road so as to represent the artillery column. A few minutes later, the commanding officer of the battery designated to accompany the infantry reports to the director at the grade crossing shown in Fig. P.' The director, representing the colonel of the 1st Infantry, gives him the following orders.

"The regiment is to drive the enemy from this park and this ridge. Be prepared to support us, and especially to take part in the attack on the park. I am trying to reach the enemy's left flank, moving under cover of the railway."

In order that the reader may fully understand the solutions proposed, complete information of the enemy will be given; then, seeing the hands of both parties, he can judge their play.

The director assumes that the enemy's resistance on the Pontaly ridge is intended only to force Red to deploy, and so delay the advance. One company and one battery occupy the ridge, the battery being northwest of the park; the orders of these troops are, that after forcing a deployment of the Red advance guard, they shall fall back upon Fontenay le Fleury, passing in rear of the park.

To check the pursuit. Blue intends to occupy the strong position at St. Cyr and the Gazé woods. The disposition of his troops there will be as follows.*

His whole force is one brigade of infantry and one battalion of artillery. Half of one regiment, with one battery (including the force sent out to Pontaly), is to occupy Fontenay le Fleury and Les Missionnaires; half the other regiment is to be at St. Cyr; the rest of the infantry and the other two batteries are to be in rear of the center, in the woods.

Solution No. 1. Battery R' designated to accompany the leading regiment and take part in the attack on the Faisanderie, behind the railway embankment, near the grade crossing shown in Fig. P.' The other two batteries are held in readiness, behind the crest just south of the Grille de Maintenon.

Special Situation No. 2. The following information is sent in writing, to the battalion commander, and to the commander of battery R':

"Battery B' opens fire upon battery R'; flashes are seen about one finger breadth to the left of the right corner of the park wall. Our infantry is stopped by Blue infantry fire from the park."

Solution No. 2. Batteries R" and R"' are brought up and take position in observation near R'. The personnel of R' takes cover when B' opens fire; after the other batteries arrive it opens fire upon the park wall.

*The organization of the French infantry is as follows: company at war strength, about 250; battalion, 4 companies; regiment, 4 battalions; brigade, 2 regiments.—*Translator.*

Special Situation No. 3. Verbally, by the director to the captain of battery R':

"You have made a breach in the park wall, and fired to support the infantry attack. You now observe that the enemy has abandoned the ridge, and apparently the park also. You receive no orders from the colonel of the 1st Infantry."

Solution No. 3. The battery commander goes in search of the colonel, leaving orders for the battery to move to Pontaly ridge.

Special Situation No. 4. Verbally to the battalion commander:

"Your infantry occupies the ridge and Faisanderie park. Battery R' has gone forward, and is near the park. You have no orders from the advance guard commander."

The whole party now moves to Pontaly ridge. Here the director, after discussing the first part of the exercise, announces a new special situation.

Special Situation No. 5. "The advance guard commander is now aware that the enemy holds the line St. Cyr—Les Missionnaires—Fontenay. Since the intervening ground is open, except in the direction of Fontenay, he decides to make his attack on that flank. The colonel of the 1st Infantry receives orders to occupy Fontenay, the battery being left under his orders.

"When this movement begins, battery R' is in column near here, waiting orders from the captain, who is with the colonel of the 1st Infantry. At the same time, the battalion commander arrives here, to request orders from the advance guard commander. His two batteries follow; the head of their column in at Lavoisier bridge."

Order's. Commanding officer 1st Infantry to commanding officer battery R':

"I am about to advance upon Fontenay; support my attack, firing especially upon the edge of the village."

Advance guard commander to artillery battalion commander:

"Take position behind this crest to support the attack upon Fontenay. Silence the enemy's artillery as soon as you can locate it."

Solution No. 5. Battery R' takes position southwest of the park; the other two batteries are held in readiness to its left rear, behind the middle of the Pontaly ridge.

Special Situations Nos. 6, 7 and 8 are communicated verbally to the battalion commander.

Special Situation No. 6. "Shrapnel fire is opened upon our infantry. Gun-flashes are seen above the crest at Les Missionnaires."

Solution No. 6. Batteries R" and R'" come into action at a trot,

at 100 meters interval, with dismounted defilade against the Missionanes crest. R" opens fire upon the Blue battery which has just fired.

Special Situation No. 7. "Fire is opened upon battery R", and flashes are seen in the edge of Gaze woods. The enemy has two batteries there, in a position some thirty meters higher than the surrounding country. They can probably see the upper parts of your guns, and are firing upon you; your batteries should have taken flash defilade against the woods. The enemy now has a 200 meter bracket on you."

Solution No. 7. The personnel of the two batteries take cover behind the shields.

Special Situation No. 8. "The Blue batteries are firing percussion hell; you have one caisson and two pieces out of action."

The party now moves to the position of battery R', and the director communicates the following situations to the battery commander;

Special Situation No. 9. "Shrapnel fire is opened upon our infantry. Gun-flashes are seen above the crest at Les Missionaires."

Special No. 9. Battery R' fires upon B.'

Special Situation No. 10. "Batteries R" and R'" open fire upon upon the enemy's artillery at Les Missionaires and in the Gaze woods; B' seems to be silenced. You are ordered to breach the wall of Fontenay cemetery (Fig. Q'), which is held by the enemy as an advanced post."

Solution No. 10. Battery R' opens fire as ordered.

Special Situation No. 11. "After a time, B' again opens fire upon R', causing considerable loss and temporarily silencing it."

Special Situation No. 12. "Suppose now that the Blue artillery is silenced by the fire of the other two Red batteries. The Red infantry advances to attack the cemetery. Give me your method of fire at each step of the attack, as I outline it.

(a) "You are again ordered to breach the cemetery wall, and support the attack upon it.

(b) "The breach is made, but the Blue infantry still holds.

(c) "Our infantry is 800 meters from the enemy; you are ordered to keep up a continuous fire and hold down the hostile infantry. Your ammunition is beginning to run short.

(d) "Our infantry is now at 700 meters.

(e) "It is now at 600 meters.

(f) "At 500 meters our infantry halts behind a little ridge, and remains there fore fifteen minutes.

(g) "It again advances to a slight ridge which you estimate to be 200 meters from the enemy, where it halts for some minutes.

(h) "It again advances, and enters the cemetery."

This ends the exercise. After making his criticisms, the director dismisses the party.

Exercise No. 2.

Detail. Captain——(2d Battery), battalion commander.
Lieutenant——(2d Battery), assistant to director.
Lieutenant——(2d Battery), battalion adjutant.

Assembly. Pontaly farm, 9 a. m.

General Situation. The battalion is with a Red rear guard, retiring from St. Cyr upon Marly. The orders of the rear guard are to delay the pursuit until the Red main body can pass through the Forest of Marly.

The first special situation is given out verbally by the director.

Special Situation No. 1. "The battalion is divided into two echelons. Battery R'" is with a detachment of infantry left south of the Faisanderie park, to force a deployment of the enemy at Fontenay and St. Cyr. The other two batteries are behind Pontaly ridge, in observation. Their position is on the forward slope of the Bailly spur, with flash defilade against Gazé woods, which, as we have seen, means 11 meters defilade against the St. Cyr and Missonaires positions.

"Battery R'" is now ordered to take position farther to the rear, near Bailly. A lieutenant is sent back to look for a suitable position.

"Lieutenant ——, you may make this reconnaissance. Start for Bailly at once; I will give you twenty minutes start of the battery.

"Captain ——, form up your 3d Battery details in column on the road, facing Bailly. You may start back to reconnoiter your position in ten minutes; your battery may follow in fifteen minutes.

"The other two battery commanders will go to their positions in observation."

Program of Exercise. 1. Occupation of position in observation by batteries R' and R", to fire upon hostile artillery already in position, whose flashes are visible:

- (a) On the front slope north of Pontaly,
- (b) Behind the railway,
- (c) Behind the crest south of the Grille de Maintenon,

2. Change of position by battery R'''.

- (a) Reconnaissance of position by a lieutenant.
- (b) Reconnaissance by battery commander.
- (c) March of battery over route marked for it, part of which is in sight of the enemy.
- (d) Occupation of position in observation.
- (e) Organization of observation system.
- (f) Simulated firing.
- (g) Reconnaissance of route to Marly by way of Noisy, on the assumption that orders are received to remain in position as long as possible, and then retire without using the main road.
- (h) Organization of a service of security, to determine the moment when the battery must leave its position, and to guard against surprise while on the way to Noisy.

In all these operations, each point is to be discussed fully as it comes up. Thus, in all the reconnaissances, the first question is, what is the general position to be selected? The next is, where, within this position, shall the guns be placed?

Then, when it comes to actual occupation of these different positions, new questions arise. The battalion commander must decide whether to hold the guns in readiness, limbered; to unlimber, but not anchor them; or unlimber, anchor, and lay on a registration point. He must consider whether fire is to be opened only upon his order; or battery commanders given a sector to observe and left free as to firing; or the order of opening fire prescribed, and battery commanders left free as to time.

The director having designated targets, the battery commanders have then to handle the fire. The adjustment may be by battery, platoon or piece, with time or percussion fuzes. If fire for registration is required, it may be time or percussion. Fire for effect may be by battery, platoon or piece; with shell, percussion shrapnel or time shrapnel; by salvos, continuous fire, single volleys, volleys at successive ranges, or zone fire.

During all these exercises, the battalion adjutant, assisted by the scouts, must provide for observation to locate targets and to assist in adjusting fire, and attend to the service of security.

Exercise No. 3.

- Detail.* Captain——(3d Battery), battalion commander.
 Lieutenant——(3d Battery), assistant to director.
 Lieutenant——(3d Battery), battalion adjutant.
- Assembly.* Grille de Maintenon, 9 a. m.

General Situation. The advance guard of a Red force, coming from Marly, has orders to seize the heights of St. Cyr and Gazé woods, to permit the main body to debouch upon the Trappes plateau. A Blue advance guard, from Trappes, is seeking to open the way for its main body to Gally Brook, and force the defiles of the Forest of Marly.

The party being assembled on the crest south of the Grille de Maintenon, the director announces the first special situation.

Special Situation No. 1. "Blue occupies Pontaly ridge, and has artillery in observation there, which has already fired upon the Grille de Maintenon. No closed body of troops can come out of the woods by the road, but infantry is coming out slowly, in small parties; it now occupies this ridge, the line of the railway, and the park at Bailly. Although it has some cover, it is suffering severely under the combined Blue infantry and artillery fire. Finding it impossible to get the artillery out at the Grille de Maintenon, the advance guard commander says to the artillery battalion commander who is with him:

"Turn your batteries back, and get them out to the main Rocquent court—Noisy road by the wood road that comes out at Noisy. While you are waiting for them, make a thorough reconnaissance of the ground and of the enemy's artillery positions, and be ready to come into action as soon as they arrive."

The director assumes that there are three Blue batteries in observation, placed behind the ridge with wide intervals. B' covers the Grille de Maintenon, B''' the ground west of the grade crossing toward Bailly. These two batteries have already been firing upon Red infantry; B'', between them, has not yet fired. The Blue battalion has all the ground in front fairly well registered. This information is not all given, however, to the battalion commander, who knows only what he is assumed to get by reconnaissance; the director gives him the following indications.

"You see gun-flashes behind Pontaly ridge, from which you estimate that the enemy has at least two batteries there. Lieutenant ——, my assistant, is behind the ridge, and will from time to time fire bombs, to give you a more definite idea of the position."

The Red batteries are sent 500 meters back into the woods. The battery commanders are then sent for to reconnoiter positions, and are conducted by an agent to the battalion commander, who is near the Bailly grade crossing, and who has received the following order from the advance guard commander:

"Put two batteries in position here behind the railway embankment, to engage the enemy's artillery. Send the third, under cover, to the other grade crossing, to report to the colonel of the 1st Infantry."

Program. The first orders given the battalion commander require him to bring his batteries out by way of Noisy, and engage the enemy's artillery. To accomplish this, the battalion commander has to reconnoiter his positions and the targets; the battalion adjutant to watch for the flashes of the bombs, determining the location of the hostile batteries and measuring their front; the senior captain, leading the battalion, to reconnoiter the road, and provide for safety against surprise, Noisy lying a little beyond the right flank of the Red infantry.

The second order divides the battalion into two parts: two batteries west of Bailly to fire upon artillery, and one southeast of Bailly working with the infantry.

Since the enemy has registered the ground, and batteries R' and R'' will necessarily be somewhat exposed at the moment of taking position, they will come into action at a trot, and then simulate fire at such targets as the director may indicate. Battery R''' will use such methods of occupying position and firing as the battery commander thinks best.

The director first follows out the action of R''', and then brings the party back to the position selected for the other two batteries. Having observed the solution of the problems assigned them, he makes his criticisms on the exercise so far, and then announces

Special Situation No. 2. "The positions of the three batteries will be marked out on the ground with flags, and the party will now represent a second Red battalion.

"The infantry situation is unchanged. The artillery situation is very unfavorable to Red; R' and R'' are nearly out of action, having suffered heavy losses, expended a great deal of ammunition and had some of the pieces damaged. R''', well concealed behind the railway embankment, has suffered but little.

"The second Red battalion comes up from Noisy by the main road; its commander is informed of the situation, and ordered to take position on the crest south of the Grille de Maintenon, and fire upon the enemy's artillery."

The party moves to the main road, where the batteries form up in column, facing Rocquencourt. The battalion commander goes forward to reconnoiter, accompanied by the director, who leaves orders

for the battery commanders to follow in ten minutes, and the batteries themselves five minutes later.

- Program.*
- (a) Reconnaissance of covered route to position.
 - (b) Occupation of position, with mounted defilade.
 - (c) Organization of observation system.
 - (d) Simulated fire.
 - (e) Advance by echelons.
 - (f) R^{'''} takes position behind railway embankment.
 - (g) Simulated fire.
 - (h) R^{'''} and R^{''''} take position on Pontaly ridge.
 - (i) Simulated fire.
 - (j) All batteries in rear prolong line on Pontaly ridge.
 - (k) Critique.

Exercise No. 4

- Detail.*
- Captain——(1st Battery), battalion commander.
 - Lieutenant——(1st Battery), assistant to director.
 - Lieutenant——(1st Battery), battalion adjutant.

Assembly. St. Cyr, at fork of Trappes and Bois d'Arcy roads 9 a. m.

General Situation. A Red force is moving from Trappes upon St. Cyr and Marly, to drive back a Blue force from the Forest of Marly to the right bank of the Seine. The Red advance guard, which includes one battalion of artillery, is in action; a second battalion, from the head of the main body, is called up to support it. The party represents this second battalion.

Special Situation No. 1. (Announced verbally by the director.) "We will assume that at 9 o'clock the battalion commander arrives at this point. The battalion is about fifteen minutes behind. Guided by an agent of communication, he reports to the artillery commander for orders.

"The batteries will form in column on the Trappes road, facing north, and remain in place twenty minutes. Battery commander will start on reconnaissance in fifteen minutes. The battalion commander will go at once to the Gazé position, where he will find the artillery commander, and also one of the batteries of the first battalion. With the artillery commander will be his battalion adjutant who, we will assume, has come ahead to reconnoiter, and is already familiar with the situation."

The director and the battalion commander ride to the Gazé position, sending the battalion adjutant ahead. The director continues:

"The advance guard occupies St. Cyr, Les Missionaires and Fontenay le Fleury. Batteries R' and R''' are with the infantry; R' just west of St. Cyr cemetery, R''' at Les Missionaires. R'' is firing upon the hostile artillery; it has an excellent position here, dominating all the ground to the front. It is about to move to St. Cyr cemetery. The fire of the Blue batteries, and also of R' and R''', will be indicated by means of bombs.

"Your orders are to relieve battery R'', permitting it to advance; place your battalion in observation here, engage the enemy's artillery, and draw its fire from the first battalion."

Program. (a) Questions to be asked by the battalion commander of the commander of the battery which he relieves.

- (b) Questions to be asked his own adjutant.
- (c) Reconnaissance of position.
- (d) Occupation of position.
- (e) Establishment in observation.
- (f) Simulated fire.
- (g) Preparation for change of position by one battery to crest west of St. Cyr.
- (h) Change of position.
- (i) Critique.

FIFTH SERIES.

Change of Position, and Replenishment of Ammunition.

This series includes three exercises on varied ground. Details in each case represent the three firing batteries, the battalion reserve, and (except in the first exercise) a wagon company from the ammunition train.

In the first exercise, each battery, under its own captain, illustrates, for the benefit of the lieutenants, the method of handling a battalion reserve. The firing batteries in action are outlined by a few mounted men, and the battalion reserve represented by an adequate detail of non-commissioned officers and privates.

In the second, details from all three batteries are combined, firing batteries outlined, and both battalion reserve and ammunition train represented. The exercise is repeated several times, the captains in turn acting as director.

In the third, details are furnished to represent firing batteries reserve and ammunition train. The major acts as director.

Exercise No. 1.

The captain acts as director, and is assisted by two non-commissioned officers. One lieutenant, with a non-commissioned officer and three privates, represents the three firing batteries of a battalion. Another lieutenant commands the battalion reserve; his detail consists of four privates as agents of communication, and one private to represent each battery reserve.

The party assembles at 8:15 a. m., in service uniform, in front of the battery stables, and is conducted by the captain to Gaillon farm, south of Chaville on the road to Bièvres. Here he explains that the exercise will consist of two parts, an advance and a retreat.

Description of the Ground.

The Chaville—Bièvres road, shown in Fig. S', comes up through the woods to an open plateau, which it reaches near *b*, runs southwesterly to the Versailles—Sceaux road, and then turns southeast toward Bièvres. Just inside the edge of the woods there is a road *fg*, metalled east of *b* only, but perfectly practicable everywhere, and four or five meters wide. Two wood roads *hi* and *jk* connect with this, running down into the Chaville valley; they are narrow, but a little way back there are open crossroads where carriages can reverse.

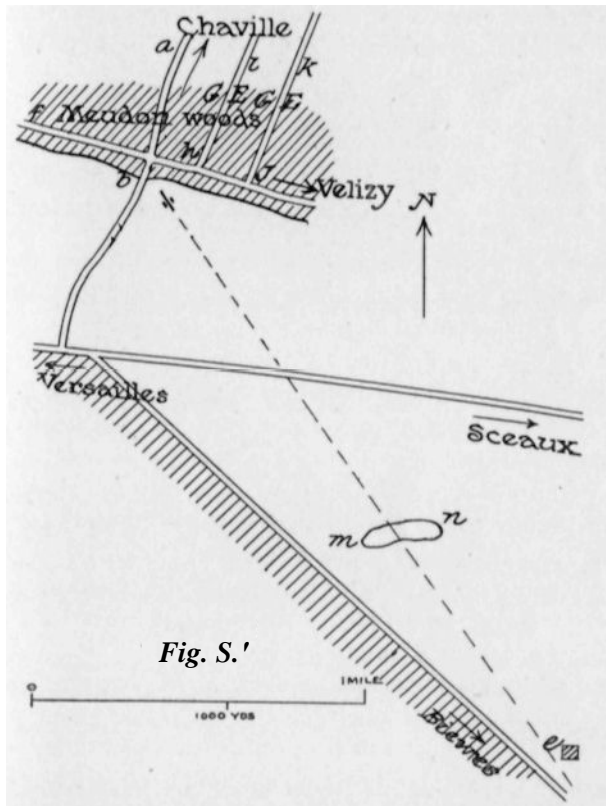
An observer coming out of the woods at *b* finds a little ridge just in front, which hides everything to the south. Advancing fifty meters or so, he comes to the top of it, and gets a good view of the country.

The ground is level as far as the Sceaux road. Beyond this is the Bièvres road, bordered on the right by woods and by the trees in the Cour Roland park, and on the left by stubble fields. The only noticeable rise in the ground is at *mn*; even this is slight, for it hides only the foot of the trees and the lower part of the houses in the distance.

This ridge *mn* is taken as the target. The firing batteries are at *l*, the battery reserves at GE.

Part 1.

Situation No. 1. The captain forms up the details in column on the road, so as to occupy the actual road space of a battalion with battery reserves, and moves toward Bièvres. When the head of the column reaches the foot of the hill at *a*, the batteries take up the trot; an agent of communication brings to the commander of the reserve the order,— "form and prepare for action."



As the firing batteries reach the edge of the woods, Lieutenant A, commanding them, receives the following verbal orders from the captain:

"Put the battalion in position to the left of the road, 50 meters outside of the woods; interval between batteries, 100 meters; direction of fire, the houses on the horizon, to the left of the Bièvres road."

Lieutenant A posts his men to mark the line of guns.

Lieutenant B, commanding the reserve, halts his men on receipt of his orders, and goes in search of a position for them. The firing batteries being in position, he posts the reserve, and sends the battalion talion commander the following message:

"The reserve is posted in column on two roads in the woods, 300 meters to the left rear of the guns."

Having inspected the position selected by Lieutenant B, the captain says to him:

"Your reserve being posted here, you see a party of mounted men come up on the left of the battalion, which you recognize as the reconnaissance party of a second battalion. A line is marked out, where you see those two men with white flags, for the guns. You receive no orders. Would you make any change in your dispositions?"

Lieutenant B writes the following message, showing his action:

"The whole battalion reserve is now in column on one road. The road vacated has been pointed out to the lieutenant commanding the reserve of the second battalion."

The party is then assembled for discussion.

Situation No. 2. The battalion is again formed in column on the road to Vélizy, and moves off at a trot. An agent of communication brings Lieutenant B orders to form for action.

Fig. T' shows the road to Vélizy. It is entirely concealed from the enemy, by the woods and by the walls and houses at Vélizy. A road leads from the village to the ridge *mn*.

As Lieutenant A comes out of the village, the captain says to him

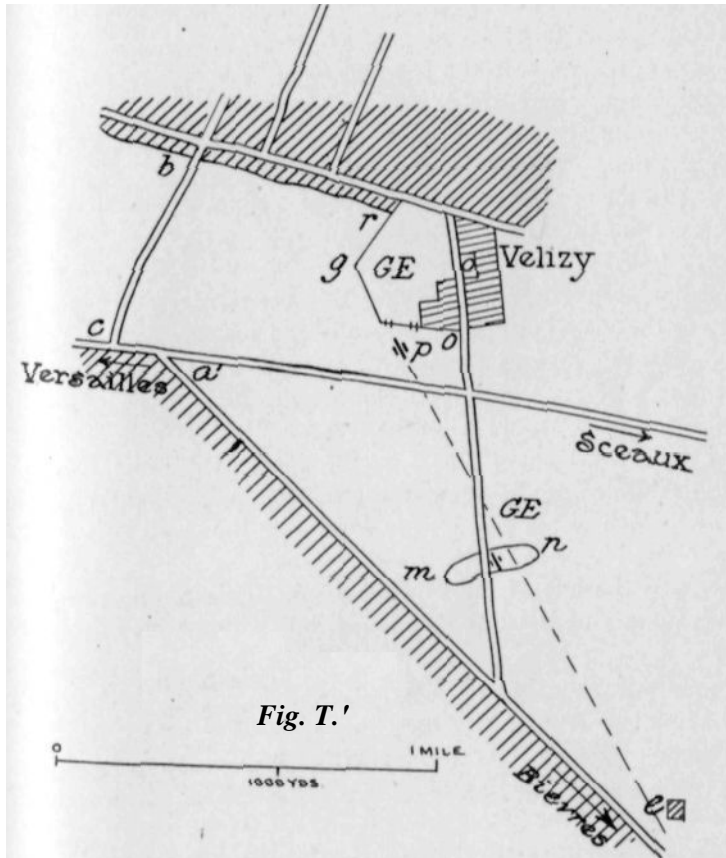
"Come into action in front of Vélizy, left on the road; direction of fire, the same houses as before."

Without waiting for orders, as soon as the batteries prepare to come into action, Lieutenant B halts the reserve and makes his reconnaissance. He selects as his position the enclosure *pqrg*, whose high walls give cover both from view and from fire. For movement to the front there are two gates; for movement to the rear, openings can be made in the fence along the road *bg*.

Situation No. 3. The firing batteries again start forward, by the road to *mn*. Lieutenant A is directed to put the battalion in position at *mn*. No orders are given Lieutenant B, who lets the batteries get a little start and then follows, he himself keeping 400 or 500 meters ahead of his column. The director rides with him, and, as they reach the Sceaux road, says:

"You now see the battery commanders go forward on reconnaissance, and the battalion form line; it comes into action in the position marked by Lieutenant A's men, firing in the direction of those houses. No orders come to you."

Lieutenant B forms the reserve in line, and posts it with its right on the road, 500 or 600 meters to the left rear of the guns.



The captain assembles the party for discussion of the two last situations, and then takes up the second part of the exercise.

Part 2.

Situation No. 4. "The battalion is with a rear guard, retiring from Bièvres upon Chaville. It is in position on the ridge *mn*, with the greatest possible defilade.

"Lieutenant A, take two scouts, and go to the rear to select your next position. The general line of march of the rear guard is the Bièvres—Chaville road.

"Before starting, study the country well from here, for the hostile artillery will probably occupy this position later; from this study, you may make up your mind where to look for your position. Give us the result of your observation, aloud, as you go along."

Lieutenant A discusses his problem as follows:

"My orders are to find a position for a battalion in rear guard. I should prefer, therefore, a position from which the batteries can retire unseen. Examining the ground to the rear, I find several possible positions. (Fig. U').

"1. In the edge of the woods, east of Vélizy; this I reject as being too far from the line of retreat.

"2. In front of Vélizy: unsuitable, as having the village in the immediate background. Besides, this position is entirely open; I can see the very bottom of the walls and houses.

"3. In the edge of the woods, west of Vélizy. This position I will pass over for the time; I can see the foot of the trees, so the position, if used, would be in the woods.

"4. To the right of the Chaville road. Here the foot of the trees is hidden, showing that there must be a slight rise in the ground which would give a little cover; but the position is not desirable, being too close to the line of march.

"5. To the left of the Chaville road. This position has all the disadvantages of the last mentioned, but without the advantage of cover.

"6. Farther to the left, the lower part of the trees is concealed, and there is a gap in the woods, visible with a glass, which seems to indicate a road. This would suggest a good position; there is a ridge which gives considerable cover, and a concealed way out; and it is directly in prolongation of the Bièvres road. In my reconnaissance, I will go directly to the last position."

Lieutenant A starts back on his reconnaissance, and the captain says to Lieutenant B:

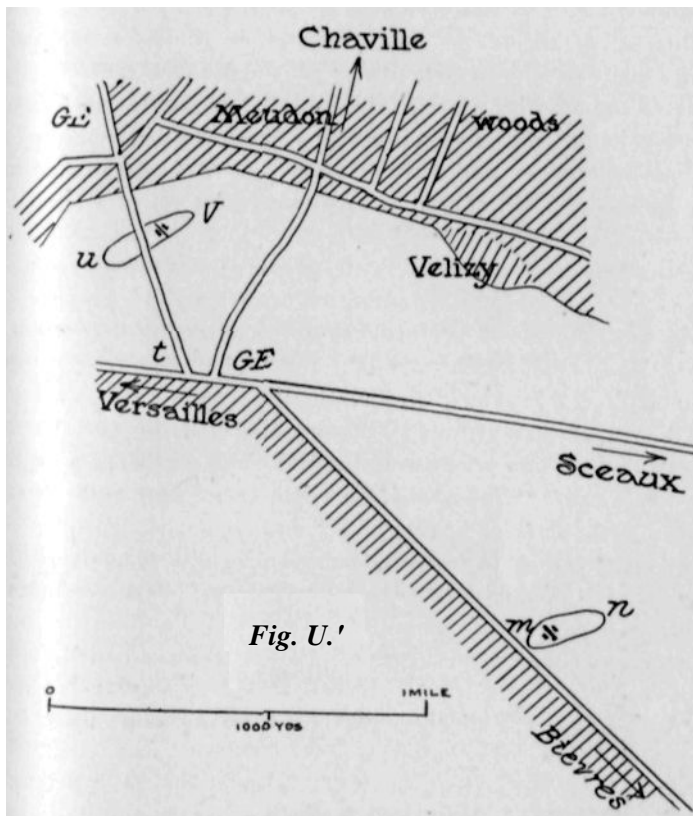
"Do you consider it time to move your reserve? If so, place it in its new position."

The reserve moves to a concealed position on the other side of the Sceaux road, behind the northeast corner of Cour Roland park.

Situation No. 5. The reserve being established in its new position, the captain sends the firing batteries back to the position just

selected by Lieutenant A. The reserve, notified of the change by an agent, moves in the same direction.

The batteries take position at *uv*, 100 meters outside of the woods, with dismounted defilade against *mn*. Lieutenant B places his reserve in a clearing a short distance to the rear, and sends men to find roads leading from there to the Chaville road. He sends the following message to the battalion commander:



"The reserve is in a clearing 300 meters to the right rear of the runs I have found practicable roads leading into the Chaville road just north of the woods."

Discussion. In the course of the final discussion, the captain calls attention to the two principal lessons of the day. The first is the importance of studying the ground; Lieutenant A succeeded in finding the one ideal position in a front of two kilometers, without hesitation or delay, simply because he studied the ground intelligently

before starting on reconnaissance. The other is that an of commanding reserves should not fear to separate himself from command; in service, orders may reach him late, or not at all, and must depend upon his own initiative and activity.

Exercise No. 2.

Captain ——, 1st Battery, acts as director. His own battery furnishes all details taking an active part in the exercise, such as chiefs of platoon, chief of scouts, commander of reserve, and commander of ammunition train. The other two batteries each furnished only one private with a flag, to represent the firing battery; one non-commissioned officer and two privates, battery reserve; and one non-commissioned officer and two privates, platoon of wagon company.

The purpose of the exercise is to prepare officers to reconnoiter positions for reserve and ammunition train; and to prepare non-commissioned officers to perform the duties of agent of communication for these organizations.

Lieutenant A commands the ammunition train company. With him is a sergeant as agent of communication with the director, who acts both as battalion commander and chief of artillery; a sergeant and a corporal, as agents of communication with the battalion reserve; a trumpeter as scout; and a non-commissioned officer and two privates from each battery, representing the wagon company.

Lieutenant B commands the battalion reserve. His assistants and a sergeant as agent of communication with the director, and a trumpeter as scout; each battery reserve is represented by a non-commissioned officer and two privates.

The first sergeant, with three privates carrying white flags, mark the positions of the firing batteries.

The details are ordered to assemble at the stables at 7:30 a. m.; preliminary meeting is held the afternoon before, when the captain explains the idea of the exercise and gives out the following.

Situation. "The battalion belongs to the main body of a division It has been in action for some time, and ammunition is running short; a wagon company is ordered up from the ammunition train to resupply it.

"Lieutenant A, you will take your wagon company out at 7:30 in the morning to Satory woods (Fig. V'), and post it just east of the Versailles—La Minière road. You are supposed to have come

from Buc, and to be about five kilometers in rear of the fighting line; art Hery fire is occasionally heard to the west. On reaching Satory, at about 8 o'clock, you receive orders from the commander of the ammunition train to resupply the second battalion, which is 1000 or 1500 meters west of the St. Cry—Trappes road.

"The rest of the party will start out with me, and go to the battery position."

Solution. In the morning the captain, with his party, rides to St. Cyr, and thence about a kilometer out on the road to Trappes. Here he forms his column at proper distances, and then moves off to the ridge *ab* (Fig. V'), where he places the firing batteries in position facing west. Lieutenant B posts his reserve under cover in a slight depression in the angle of the roads to Trappes and Fort St. Cyr (GE, Fig. V'), 400 or 500 meters in rear of the batteries; this selection of position is approved by the director.

Lieutenant A, in execution of his orders of the day before, calls up an agent of communication as soon as he reaches Satory, and says:

"Go and tell the chief of artillery that I am here, with orders to supply the second battalion. If you cannot find him, report to the battalion commander direct.

"The battalion is about five kilometers away, in this direction. If you go straight ahead, you will come to a broad paved road; crossing it, you will find the batteries about 1000 or 1500 meters beyond."

The agent loses his way; the director, hearing nothing from Lieutenant A, sends an agent to him at 8:15, with the following orders:

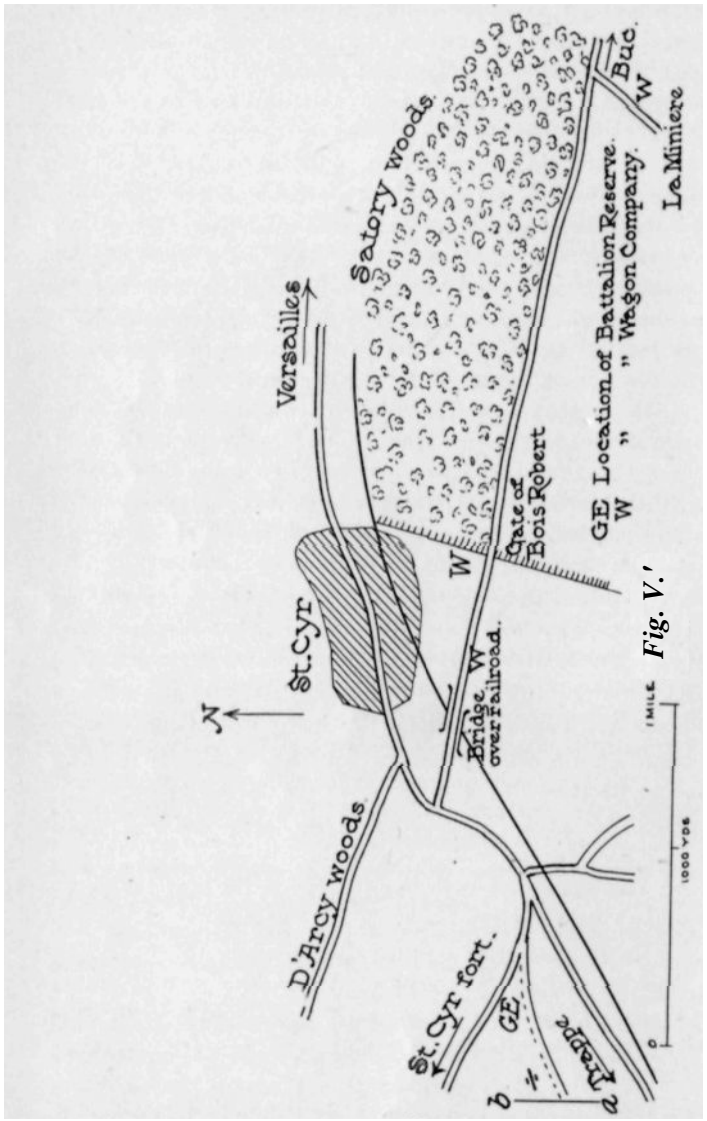
"Bring ammunition up without delay for the second battalion; form your park in front of the wall at the Porte de Bois Robert."

Receiving this order at 9:15, Lieutenant A brings up his detail at a trot, and forms park in a field west of Bois Robert. He immediately sends all his agents of communication to the battery positions, and himself remains at the park.

Discussion. The captain leaves men in position to mark the batteries, the reserve and the ammunition train; the rest assemble for discussion on the bridge over the railway tracks south of St. Cyr, from which all three groups of markers can be seen. The captain's criticism is as follows:

"I have no remarks on Lieutenant B's dispositions, which I entirely approve. I have, however, several comments to make on Lieutenant A's work.

"1. *Establishment of communication.* An unforeseen incident occurred; Lieutenant A's agent of communication lost his way, and



failed to deliver his message. This was quite excusable, considering the thick fog we had this morning; and anyhow, I am not sorry it happened. It delayed us, of course, and prevented me from carrying

the exercise as far as I had intended; but it brought out a situation that may often happen in service. Accidents of all sorts will prevent prompt establishment of communication, and require the use of several agents to deliver one message.

"Lieutenant A should have shown more initiative. Knowing that these exercises do not generally last more than four hours, the long delay in receiving orders should have made him suspect something wrong. There was the more reason for fearing this, in that he sent off his agent without showing him his precise road, which he might have done, but giving him only his general direction.

"2. *Reconnaissance and selection of position.* Lieutenant A's orders were somewhat vague, as may ordinarily be expected in service; he was directed merely to form park in front of Bois Robert. The ground just west of the wall and north of the road looking good, he formed park there, complying literally with his orders.

"This was not the best course. Instead of coming up at the head of his column, he should have come rapidly to the front as soon as it was on the road, posting men with care to mark his route, on account of the fog. At Bois Robert he should have left orders for the column to halt; then he should have come up until he could see the batteries and reserve, and gone back to locate his park. The place I should have selected is just east of this bridge, a few meters from where we now stand.

"3. *Selection of observing station.* As soon as the park was formed, wherever it might be, Lieutenant A should have chosen a position for himself from which he could see the batteries, their reserves, and the park itself. This bridge would have been a suitable place.

"To sum up, we may deduce from this exercise certain general rules for the handling of ammunition trains.

"The regulations speak of two positions for wagon companies of the ammunition train. The first, some five kilometers from the batteries, is occupied upon the order of the chief of artillery; the second, about 1500 meters in rear, when the company is ordered to supply a particular battalion.

"The receipt of the first order shows the commanding officer that he will soon be needed, and his first thought should be to establish communication, so as to be ready to respond to any call without delay. If further orders do not come soon, he should send for them, and never run the risk of being behind time through the fault or negligence of an agent of communication.

"When he gets orders to come forward to supply a battalion he should remember that ammunition may give out at any moment and must be supplied promptly at all hazards. His company become a part of the battalion for the time being, and always remains in touch with it. As a rule, no definite position will be prescribed for it, but merely a line which must not be passed; he should come on well ahead of his column, to select a place for the park; this should be as near as possible to the battalion reserve, without taking underisks or interfering with freedom of movement.

"The park formed, his duty is to observe the battalion, and follow the course of the action, so as to be ready to supply any demands upon him, and note promptly anything calling for a change in his position.

"Orders brought him by agents are intended as guides only, and should not be obeyed blindly. Just after an agent starts, there may be a sudden change in the situation; batteries may, for instance have to fall back suddenly, and if he does not see this his park may be in the way. He must not remain inactive for lack of orders; it is his business to ask for them at the proper time, or act on his own responsibility if necessary.

"He is responsible for maintaining communication. Officers with the batteries have their attention concentrated on the enemy; they cannot be expected to look out for ammunition trains.

"In a word, to handle ammunition trains properly, an officer need apply only a few simple general rules, but he must display great energy and initiative."

(TO BE CONTINUED.)



MAJ 75 100 1500 2000 3000 4000 5000

Echelles Métriques (400000)



FIELD ARTILLERY MATERIEL OF GREAT FIELD OF FIRE

(DEPORT SYSTEM)

LT. COL. A. DEPORT IN REVUE D'ARTILLERIE, JUNE, 1911.

Translated by Lieut. Cortlandt Parker, 6th F. A.

Introduction.

Present rapid fire field materiels have, under the conditions of modern warfare, serious disadvantages which must be remedied. These disadvantages are:

1. The limited extent of the horizontal field of fire which is reduced to 6° on account of the smallness of the base of anchorage furnished by the trial spade.

2. The limited extent of the vertical field of fire which is 17° after the spade is sunk, and about 12° before it is sunk.

3. Last, the complexity of the operations devolving on the gun pointers, which in rapid firing, compromises the efficiency of the weapon.

Necessity of a Great Horizontal Field of Fire.

At the moment of the entry into action of the artillery, the targets of the batteries will be vague and indistinct, for each battery placed then in the open, would be wiped out before being able to produce any useful effect. Under these conditions the initial orientation given to the guns will be long in point of time, hesitating, and uncertain, and, it is safe to predict, changes in the position of the trial will be many before the position of targets becomes well known.

But each change of orientation, even as small as 3° on either side of the axis, necessitates placing the spade clear of the hole where it is sunk and involves the following operations: releasing the brake, lifting the spade from its hole, pushing the carriage slightly forward or backward, orienting anew the carriage (those operations lowering the gun an amount equal to the angle through which the spade had sunk), relaying in elevation and direction, resetting the brake, then relaying the gun after the first shot which sinks the spade, relaying in elevation and direction, and banking up again the little pile of earth which closes the 20 cm. of interval between the bottom of the apron and the ground.

As the caisson is next the gun, it must undergo a similar displacement. During all this time and up to the time the spade is sunk again by the recoil, the cannoneers may not occupy their regular posts under shelter of the shields.

It should be noticed that these multifarious duties must be executed just at the moment when, the position of the enemy being known, there is a vital importance in outstripping the enemy in fire adjustment to gain a superiority of fire over him.

Later when one of the antagonists decides to pass to the offensive, the action of the batteries should be exerted to the utmost to support the advance of the friendly infantry in the attack, or on the defensive to paralyze the advance of the hostile infantry.

But the attack of a position or the enveloping of a wing are generally executed by movements on the flanks which would involve, for the artillery, frequent changes of orientation. The displacements of the materiel heighten the disadvantages previously noticed in that the infantry, almost always concealed or sheltered by accidents of the ground, is visible only during the short time in which it makes a rush to the front, so that changes of orientation involve a dangerous delay and cause moreover a loss of contact with the target.

Still later, in the closer and consequently enveloping combat, it is clear that the limited field of fire of the present guns is altogether insufficient.

Finally, it is recognized that the matériels with their present trial spades and limited horizontal field of fire are out of place when it comes to firing on targets moving transversely or obliquely, on account of the necessity of depressing the gun and repointing it all over again after each change of orientation.

Moreover, these matériels are obviously insufficient when it comes to firing against dirigibles and flying machines.

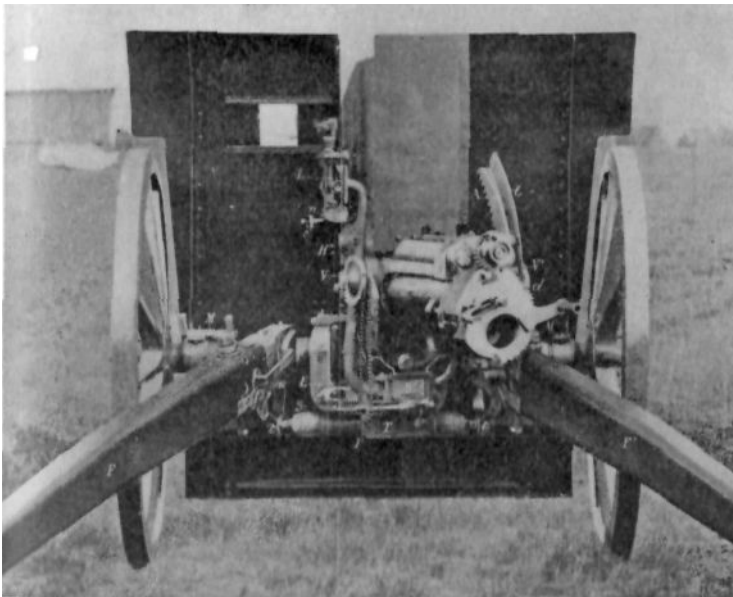
The conclusion is that, under modern war conditions, a field gun of great horizontal field of fire would have, all things being equal, a considerable superiority over present guns.

Necessity of Great Vertical Field of Fire.

The necessity of a great vertical field of fire is likewise imposed; for the present field guns, which generally ought to have a flat trajectory for searching large spaces, are often unable to reach an

enemy protected by covering masses and to accompany the infantry attack far enough, neutralizing the hostile infantry, without risk of hitting the friendly troops.

In warfare over mountainous or merely rough country the maximum angle of 17° of which the present rapid fire guns are possessed, the spade being completely sunk (an angle which is reduced to 12° when the spade rests on the surface) will often be insufficient, for this angle should include the angle of site (which may be considerable), the angle through which the spade is sunk and the



The Deport Field Gun.—Maximum Traverse Lift.

possible descending slope of the ground. The result is that not enough margin is left for the angle of elevation due to the range, even in case of fire of flat trajectory.

Moreover, when it is possible to fire with the present gun at an elevated target from a low position, the angle of fall is unfavorable. But with our system which permits of a vertical field of fire from -10° to $+50^\circ$, it would suffice to fetch from the artillery park a few caissons of prepared half charge cartridges to give to our field batteries the means of easily employing a curved trajectory in certain cases where the normal trajectory is not to be utilized.

It is not a question of displacing the 12 and 15 cm. howitzers whose function it is to wipe out by a powerful fire of their heavy and costly ammunition, targets of particular resistance, but of extending the role of field guns, always at hand, to the employment with curved trajectory.

Since the gun of great vertical and horizontal field of fire is built, as concerns laying, as though it were mounted on a pivot bolted to a fixed platform, it may also be employed to fire against dirigible balloons and flying machines. Thus it will be unnecessary to have recourse to a special materiel, a materiel moreover generally useless for if mounted on automobile it must follow rough and obstructed roads, and if not mounted on automobile, the pieces will be too few in number to be present at need at the desired time and do good action.

On the contrary, with the gun of great field of fire, the dirigibles or flying machines attempting a reconnaissance, must meet the fire, not of a special gun of a model not yet created, but of numerous guns suitably oriented and capable of holding these machines at a distance or of destroying them.

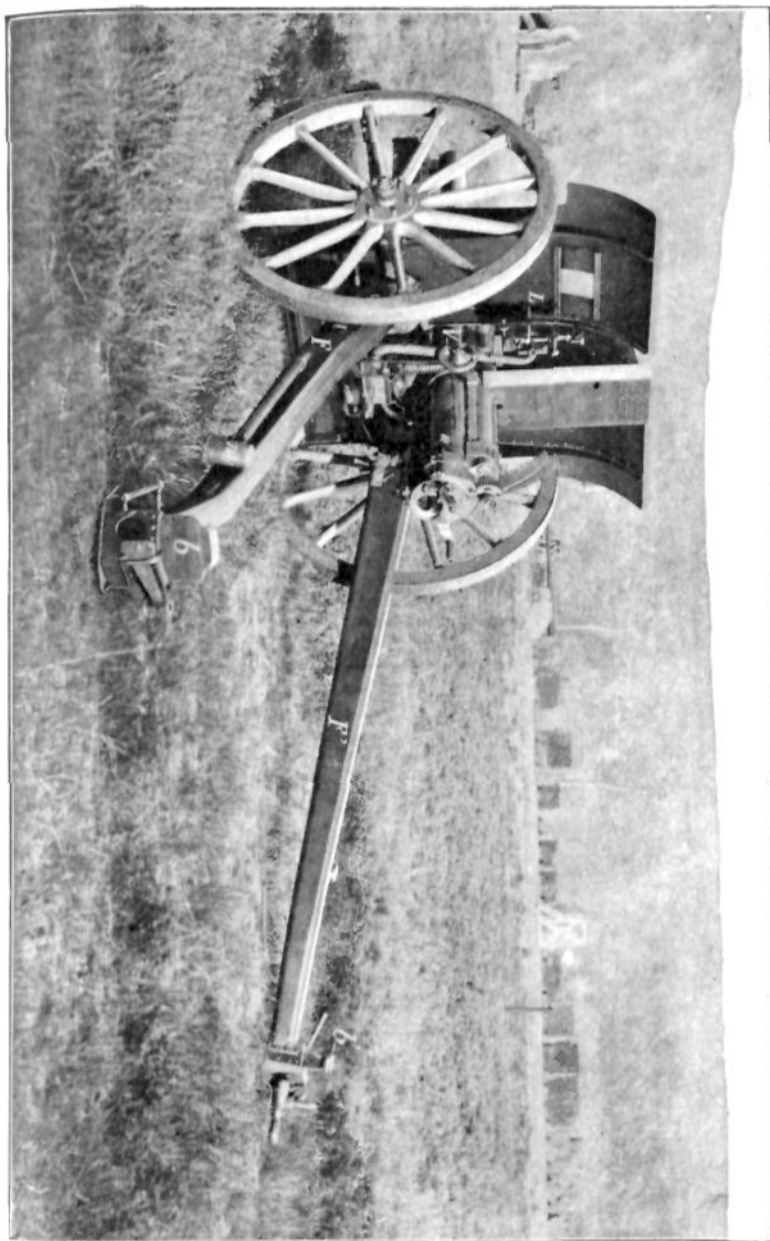
We conclude from the preceding that the field gun answering the requirements of present tactics should have a great field of fire in direction and in elevation, so that the officer commanding may at his will and without modifying the base of anchorage of the carriage, direct the sheaf of fire at a moment's notice on any target fixed or moving, which appears in this broad sector.

Necessity of Simplifying the Processes now Involved in Firing.

Independently of the preceding desiderata, the daily use by troops of the present rapid fire guns has caused the recognition of the fact that the methods and processes of fire in use are too complicated for the vast majority of officers and cannoneers called out on mobilization.

It is clear that the rapid fire gun can be really effective only if the permanence of the laying of the gun is assured, since an error in range of a few mils may destroy the effectiveness of percussion as well as time fire.

It is well understood that with materiels where the gun pointer must give at the same time the laying in elevation and in direction, as well as the changes of range, the duties of this pointer are much



The Depont Field Gun.—Normal Position.

too complex, even in the case of service practice at perfectly visible targets.

That is why we have been led to give the 75 mm. French materiel an independent line of sight,—to divide the laying operation between two cannoneers. One of these has but to direct on the target a fixed line of sight, thereby giving the direction and the angle of site, while the additional or range table elevation is given separately and simultaneously by another cannoneer who operates a graduated disk by means of a special handwheel.

But the relaying after each shot by direct laying, on a target soon concealed by the fire and the bursting of projectiles, is long and difficult. Therefore, instead of giving a sight on the target as the basis of laying in range, it is infinitely more rapid and certain to assure it by keeping a bubble of a level tube between marks.

If we pass from the proving ground fire with a single gun to the fire in war of batteries on the almost invisible targets of the present day, the necessity of avoiding laying by a direct sight will appear still more imperative.

The fact is, targets which the officer commanding might recognize with difficulty, through his field glasses, would be very difficult to point out to the gun pointers and very difficult for them to follow. In this way there would very often be different pointings from one gun to the other. The officer charged with the adjustment of fire would then be in the impossible situation of having to give a single range for different trajectories.

Besides, individual pointing by a direct sight is impossible in fire from behind a mask, which is becoming more and more general.

Errors in laying would occur likewise where the duties of the gun pointers were too complex for them to effect with certainty all the corrections devolving on them from shot to shot. So even in those materiels where the gunner does not have to lay off the range, it is certain he has too much to do, since in rapid firing he has to work two handwheels—one to give the direction to the gun or to sweep, and the other to keep the angle of site bubble between its marks.* Most gunners cannot keep the bubble between its marks from shot to shot. This fact causes marked variations in height of burst in time fire and considerable errors in range in percussion fire, whence it results that the efficiency of the materiel

* This does not apply to the U. S. materiel—Translator.

may fall off greatly, according to the skill and training of the gun pointers.

We lay it down as a principle that, in the new conditions of war, the direction given the gun should be entirely in the hands of the officer commanding, and not dependent on the more or less uncertain comprehension of the gun pointers. Except for these special particulars, the operations of laying should be as follows:

In direction, the laying of the different pieces should be on an aiming point perfectly distinct, easily designated, and independent of the target.

In elevation, the angle of site should be announced by the commanding officer and the gun should be permanently laid with that as an angle of site by merely keeping the level bubble between marks, without sighting on the target. The additional elevation or range elevation should likewise be announced by the officer commanding and given by simply bringing the graduation indicated opposite the index.

Thus is obtained the collective distribution, the elements contributing to which are entirely in the hands of the officer commanding, the gun pointers being merely machines with nothing but an extremely simple mechanical operation to perform from one shot to another.

If the duties are divided in such a manner that each of the gun pointers has to manipulate but a single handwheel from shot to shot, and if the stability of the materiel occasions only very slight corrections, permanence of laying and consistency in the fire will be attained, and the officer commanding will be able to adjust and conduct his fire with assurance.

At present rapid fire materiel is made to be served by professionals of the proving ground from the firms or trial boards, and the efficiency of the gun diminishes in vast proportions when these materiel are placed in the hands of the troops who are called on to use them.

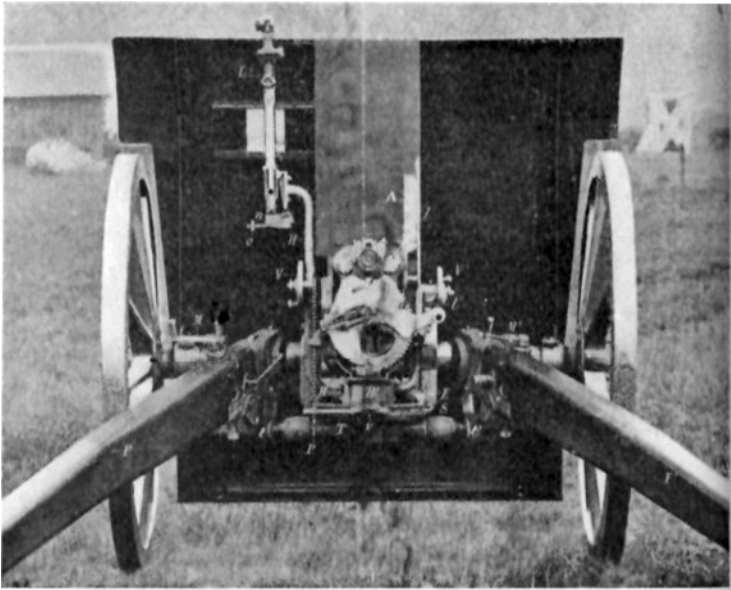
To execute rapid firing without being sure of the correctness of the laying is to waste ammunition.

Whether masked fire or an open position is involved the method is the same. It might be thought that in case of fire on a visible target, it would be advantageous to let each gunner point directly and individually on the target. On the contrary, we believe that when a battery receives the serious mission of taking an open position to fire on a visible target, it will be better to have the battery

preceded by a reconnaissance officer so that at its arrival the battery will receive all the data necessary for opening fire at once, viz deflection, angle of site, range, corrector.

It is perfectly useless for the battery to remain exposed to hostile shots in silence while firing data are determined, which might have been determined in its absence. It is only in the case of fire on a moving target that direct laying is necessary.

It is for the officer commanding, who has recognized through his glasses the target to be attacked, to have the initial firing data determined, then to rectify these data from the observation of shots.



The Deport Field Gun.—Normal Position.

The materiel should be so arranged that the different operations of laying may be executed simultaneously and that each pointer has but a single function to perform, a single handwheel to manipulate from shot to shot, so that we may be sure of the correctness of laying, even with very ordinary pointers.

Finally, we have just seen how rapid fire field guns now in use have, by reason of the new conditions of war, an entirely insufficient horizontal and vertical field of fire. Besides this there devolve on the gun pointers complex operations which cannot be executed

during rapid firing, from which there results a terrible expenditure of ammunition with very small return.

It is to remedy these disadvantages that the type of field materiel which we describe below has been invented.

Short Description of the Materiel.

To obtain the great horizontal held of fire, we replace the single trail of the present carriages by two half trails, articulated with the axle and connected each one to the other by a crosspiece which supports the chassis of the cradle. These half-trails are assembled to form a single trail for travelling and they may be greatly opened on going into battery so as to furnish a base of anchorage embracing a sector of 54°. The cradle mounted on a vertical pivot on the axle may thus be traversed to the extreme limit, without the direction of the energy of recoil leaving the base of anchorage.

To assure the anchorage of the two half-trails we employ the system of sliding spades* already used in the French mountain materiel, model 1910. The spades are sunk into the soil before firing by means of several blows from a sledge given while the gun pointers are laying the gun. This mode of anchoring presents the following advantages:

The carriage is permanently anchored before firing and the cannoneers may at once take post under shelter of the shields.

The displacement from the original laying, due to the recoil and the sinking of the present spades, is eliminated.

The sill of the float is immediately supported by a large surface on the unbroken earth and the spades bear against their prisms of earth not at an acute angle, as do the present spades which tend to plow a furrow in the ground, but at an obtuse angle, all of which favors resistance and the compression of the earth.

The sledges used to sink the spades, present on one side a striking face of steel and on the other a face of green leather similar to that used in the makeup of silent gearing. These sledges are equally useful in making camp.

One is tempted to believe at first sight that, with this materiel, coming into action will be slow. In reality it is very quick, because the initial orientation of the carriage, by only a rough approximation, is instantaneous and the sinking of the spades requires only fifteen seconds, much less time than is required in setting the brakes and

*French patent 392044 dated Sept. 14, 1907.

laying the gun. In short range as well as long range fire the cannoneers are at their posts, sheltered by the shields, before the first shot, and there is the immense advantage of being able to use a great field of fire without even moving the trail spade or changing the orientation of the shields with respect to the enemy.

To obtain the great vertical field of fire, with the small height of axle which is allowable for field guns, we substitute for the single cradle of the present materiel, with its long recoil of 1.3 m., parallel to the piece, by two coupled cradles.

The carriage-cradle (the lower cradle) permits a recoil of 1 m. This cylinder supports the trunnions of a piece-cradle permitting a recoil of 36 cm. This latter cradle may be inclined at an angle of 50° to the first cradle, by means of an elevating mechanism.

In ordinary fire near the horizontal, the two cylinders combine to give a total recoil of 1.36 m. This assures the stability of the materiel. In fire at great angles where the overturning of the materiel is not to be feared, the gun may recoil down only through the small length of the piece cylinder (the upper cylinder) and consequently may be fired when elevated to 50° . The two coupled recoil mechanisms take up automatically the recoil from any given angle of fire, without need of any other connection between them.

In laying in direction, the rotating system is balanced around its vertical pivot so that changes of orientation are made very rapidly at an angular velocity of 32 mils or 2° per turn of the handwheel. In laying in range, alterations are likewise effected very rapidly, at 16 mils per turn of the handwheel.

We employ for our breech mechanism the well-known eccentric screw system of the French 75 mm. materiel. We shall note here only a few of its principal advantages.

The breech block, having a continuous thread of great diameter is exceptionally solid and very short. It is opened or closed in one motion by a rotation of about a quarter turn.

The breech mechanism does not become more bulky and cumbersome when the block is in the open position, since it never leaves the piece; the wedge or interrupted screw systems would reduce the horizontal field of fire since the block in the open position would strike the trails. Our system permits of loading with a complete cartridge under all angles of fire. The shoving home of the cartridge has the effect of starting the closing movement, on account of the pressure exercised on the cam of the extractor, so that the cartridge shoved in is automatically held in position.

If the hand of the cannoneer loading the gun accompanies the base of the cartridge, the hand cannot be pinched in the closing because it turns with the breechblock.

The eccentric screw block possesses absolute security against premature discharges during the closing of the breech, because the firing pin cannot come opposite the primer until the breech is closed. The breech-block mortise forms a smooth and extremely convenient loading tray. The eccentric screw system, moreover, is well adapted to a semi-automatic mechanism, because to open and close there is necessary only a small rotary movement. Finally, our breech block carries an arrangement for continuous semi-automatic fire. A gear, which may be disengaged, permits of passing from the semiautomatic operation to operation by hand.

In our 75 mm. breech mechanism, the semi-automatic operation has been attained as follows:

The exterior surface of the rotating block has been provided with a rack which engages with a pinion centered on an axis formed of a long screw with a reversible thread. This screw is engaged in a collar situated in a cylinder hollowed out in the piece cradle. The recoil of the piece on this cradle has the effect of making the screw slide in its recess fixed in the cradle and of causing the pinion to turn. The breech is then rapidly opened on recoil, the cartridge case is ejected and the block in the open position is engaged with the extractor. The recoil has in addition the effect of bending a closing spring which closes the breech quickly as soon as the seating of the cartridge releases the extractor.

This automatic arrangement reduces the manual labor to merely inserting the cartridge. This simplifies the whole operation and renders pointing the gun surer and easier. All this increases the effect of the fire.

We have indicated above the principles of construction of the new carriage. These basic principles have been carried out as follows:

The opening trails are articulated to the axle, where the central part is bent out in the form of the letter E to receive the revolving *rocker* which constitutes a chassis or carriage body, extremely simple. The connection between this and the half-trails is effected in the following manner:

The under side of the body carries a wheel to which is articulated a cross-piece or beam whose extremities are connected to the half-trails

by elevating screw segments operated by handwheels. The simultaneous operation of these handwheels effects the rapid rotation of the axle and, consequently, the desired inclination of the rocke for fire or for its route position. The handwheels are used not only to give rapid elevation and depression to the piece on going into action or at other times, but also to give the cradle the inclination of the angle of site.

To the carriage-cradle is fixed a vertical rigid tubular arm which serves as a support for the panoramic sight and for the traversing handwheel.

With the system of coupled recoil cylinders the return of the piece to battery after each shot requires only light running up gear. It is made up of small helicoidal springs, requiring lubrication only a long intervals.

The cylinders are hydraulic cylinders of great simplicity without buffers or valves.

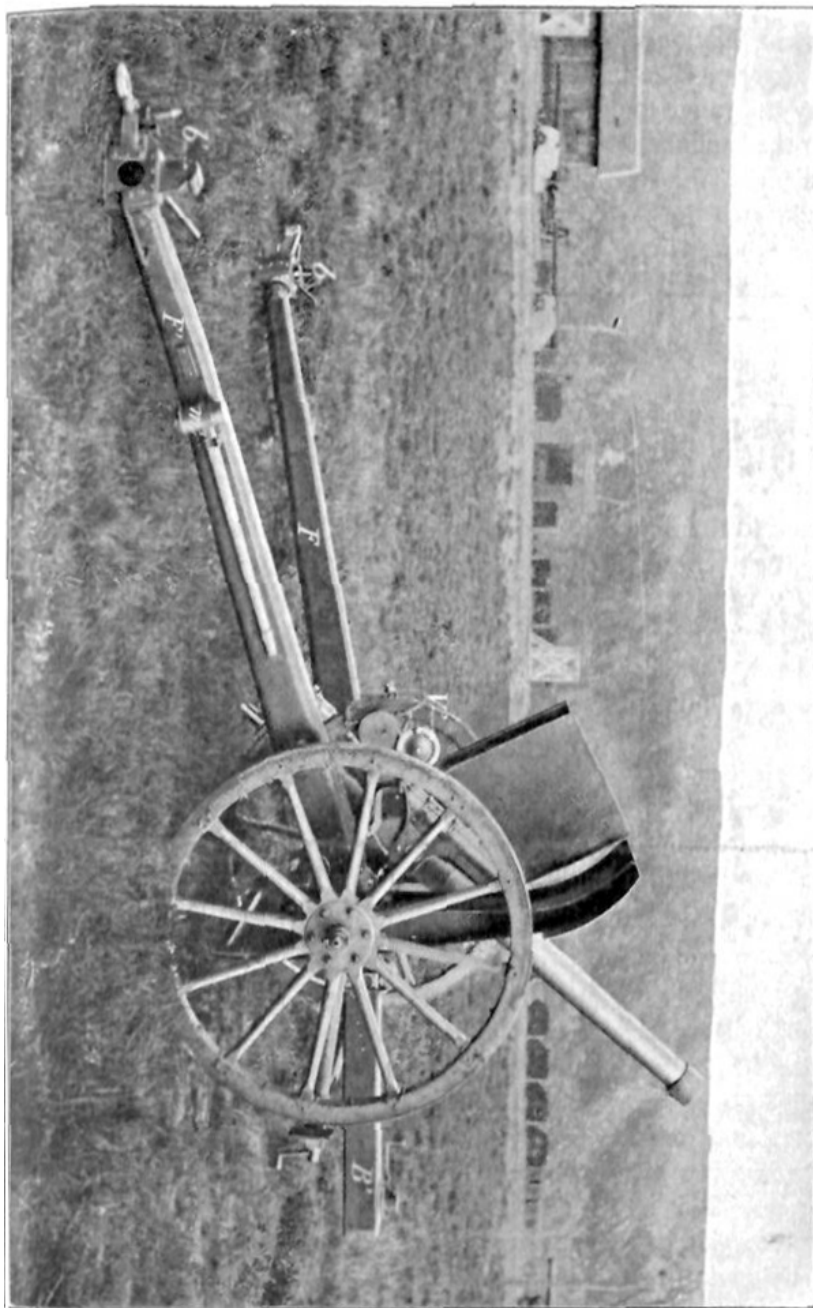
The under side of the bent frame of the axle is provided on its front edge with an endless circular rack, concentric with the vertical axis of the carriage-cradle. A tangent screw is placed on the rear of this cradle and gears with the rack. This tangent screw is actuated through a pinion by a sprocket chain which engages with another similar pinion carried by the tubular arm of the cradle. This arm supports at its upper end a sight socket for the Goerz panoramic sight.* mounted on an axis which is kept constantly parallel to the axis of the gun by a gearing which corrects for the difference of level of wheels. The traversing handwheel is placed convenient to the hand of the gun pointer, who has his eye at the panoramic sight. Each turn of the handwheel corresponds to an angular displacement of 32 mils. The face of the handwheel is graduated to permit of sweeping fire.

The laying in range may be effected in two ways, either by a direct sight on the target or by the level.

Direct Laying.

Angle of Site.—The cannoneer on the left having his eye at the panoramic sight has in his right hand the traversing handwheel and in the left hand the handwheel on the left trail which is used to give

*There is no sight shank, as this sight is used in direct laying only to give the angle of site.—Translator.



The Depont Field Gun.—Maximum Elevation.

the cradle its inclination. These devices permit him to direct the panoramic sight on the target, and thus give to the carriage-cradle the inclination which corresponds to the angle of site of the target.

Range.—The inclination of the gun to this line of sight, that is to say the range table elevation, is given *simultaneously* and *separately* by the cannoneer on the right by means of the range elevation mechanism. This mechanism connects the carriage cylinder (lower cylinder) to the piece-cradle (upper cradle) in which the gun recoils and whose trunnions are carried by the lower cylinder. It is composed of a stout toothed arc forming a part of the piece-cradle. This arc gears in with a pinion carried by the lower cylinder. This pinion is actuated by an endless screw. The whole system of the piece and piece-cradle is balanced around its trunnions so that there is only a slight preponderance, which renders the control very easy and rapid.

Ranges are indicated either in mils or in range on a graduated limb fixed to the toothed arc of the piece-cradle, and the index is carried by the carriage-cylinder (lower cylinder).

By turning the elevating handwheel, the cannoneer on the right can thus give to the piece-cradle (upper cradle) the range table elevation with respect to the lower or carriage-cradle in which the lower cylinder slides, and as this latter cradle carries the panoramic sight and is inclined to correspond to the angle of site of the target, the piece is laid in elevation on the target.

Thus, while the present cradle and piece are always parallel and integral during the laying, with this materiel the piece is inclined to this cradle at an angle which corresponds to the range table elevations.

Indirect Laying.

In the case of laying for elevation by the level, which, as has been seen, is the general case, the carriage-cradle is provided with with a fixed level placed on the right and the right cannoneer can keep the bubble between marks, that is to say, put the carriage-cradle in a horizontal position by turning the right handwheel. The angle of site is given by simply displacing the index which is the origin of ranges. This index, marked on a movable slide, is displaced along a limb carried by the carriage cylinder and graduated in mils.

By giving to the piece the range table elevation with respect to this index and by adding to this last the angle of site of the target the piece is laid in elevation.

In laying for elevation by the level, the left cannoneer has but to manipulate the traversing handwheel and the right cannoneer, once the angle of site slide is placed, has but to keep the bubble between its marks and to set off the ranges ordered. Generally he need not occupy himself with opening and closing the breech as this is accomplished automatically.

In normal conditions of firing, therefore, the operations of laying the gun are divided between two cannoneers who accomplish this simultaneously, the cannoneer on the left for direction, and the cannoneer on the right for elevation, each with a single handwheel.

This division of work is such as to insure accuracy of laying and consequent effectiveness of fire. There is much to be desired at present on each of these counts on account of the multiplicity of duties imposed on the single cannoneer.

Duties of the Cannoneers.

The service of the piece (in battery or elsewhere) requires normally *four* cannoneers, viz:

1. Gun-pointer on the left, at the panoramic sight.
2. Gun-pointer on the right, for laying in elevation.
3. A second cannoneer on the left, loader.
4. A provider of ammunition to the left of the loader, behind the caisson body.

The cannoneers having performed the usual duties to prepare for action, Nos. 3 and 4 unlimber the gun, orient the carriage quickly in the general direction given by the chief of section, open the trails, seize the sledges and drive in the spades.

During this time, Nos. 1 and 2 put in their sockets the panoramic sight and the elevation level. As soon as the trails are opened they operate together the handwheels of the trails to elevate the gun. The chief of section releases the gun and gives the angle of site commanded. The left gun pointer lays for direction (and for elevation in the case of direct laying); the right gun pointer operates the elevating mechanism to give the elevation corresponding to range and operates also the handwheel on the trail to put the bubble between its marks (in the general case of indirect laying).

The loader has opened the breech and loaded the piece with a cartridge delivered by the provider of ammunition.

The gun is ready to fire, the gun pointers seated on their trail seats and Nos. 3 and 4 at their posts.

Since the discharge causes generally no recoil on the wheels, no sinking of the spades, and no sensible displacement of the line of sight, rectifications in laying are effected at once.

Principal Data of the Materiel.

Normal weight of the projectile	14.3 lbs.
Weight of the charge of nitrocellulose powder.....	1.3 lbs.
Initial velocity	1,673 ft. per sec.
Weight of the gun carriage.....	2,293 lbs.
Weight of the limber with 22 cartridges	1,234 lbs.
Weight of the piece limbered	3,527 lbs.
Height of axle.....	2.79 ft.
Normal horizontal field of fire	45°
Possible horizontal field of fire.....	54°
Normal vertical field of fire.....	10° to + 50°
Possible vertical field of fire.....	10° to + 70°
Radius of the circle in which the wheels turn	29 ft.

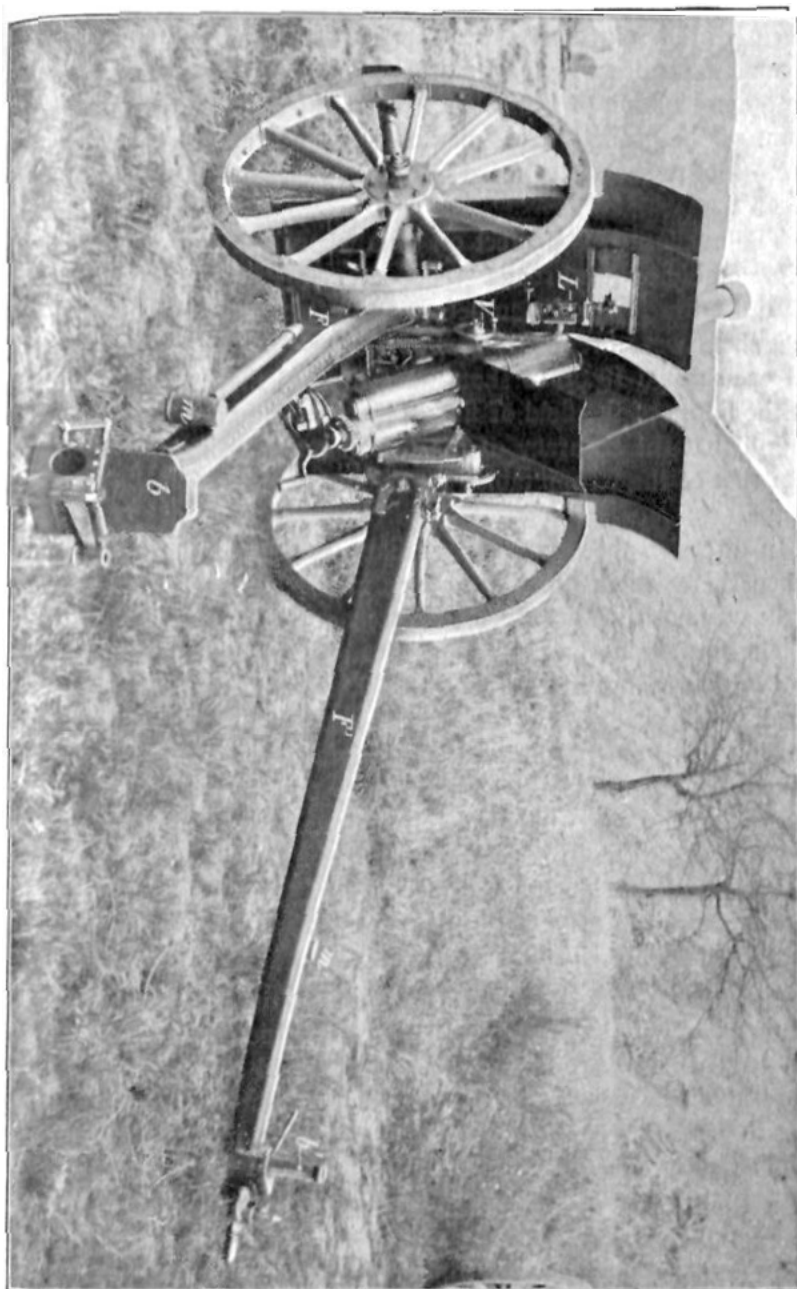
Trials at the Proving Grounds at Cirie.

The materiel was under trial for five months before an Italian board; it fired during this period 1,995 shots and traveled 1,000 kilometers in road tests. It had already fired 195 shots at Montlucon of which 200 were Italian cartridges and the remainder cartridges loaded with 600 g. of French powder.

The trial board, after the dismounting and a detailed examination of the materiel, carried out the usual series of firing, observing the functioning of the materiel, the ballistic properties, the precision and rapidity of fire and the endurance of the materiel, and then finished by tests consisting of taking position and firing under service conditions, comparing this materiel with their regulation Krupp materiel.

The fire testing the functioning of the materiel was carried out on varied ground and under varied conditions. The proving grounds were flat, sloping, slanting, sloping and slanting, sodded, plowed, marshy, of sliding sand, of ballast, of granite, of armor plate, on hard and dry roads or roads frozen hard, the trails being on a level or at very different levels. The carriage was even sunk in a pocket of quicksand.

From these trials, it was concluded that the materiel, thanks to its opening trails and sliding spades, has an unmatched stability on all kinds of ground, that the displacements of the line of sight are frequently



nil or extremely small, that the materiel may go into action in most difficult spots and that the change in the line of sight, caused by a combination of a displacement of the axis of the gun with the slant of the ground, occasions but small deviations, easy to correct from shot to shot. The board found the normal useful field of fire to be 45°.

The anchorage is perfect on soils where ordinary spades usually slip, notably on hard roads.

In the fire for precision before and after the principal road tests, 305 shots were fired at ranges of 1,000, 3,500, 5,000, and 6,000 m. At each range 10 or 15 shots were fired to the front and as many at the limits of the field of fire, with or without a slant. The board found that the accuracy of the fire in range, using the fixed level, was that of the Krupp tables throughout, while the gun was in good shape.

In direction the accuracy was likewise that of the tables, except when there was a great difference in the level of the wheels; the sight was not then arranged to correct for this.

The fire testing ballistic properties gave at first normal velocities and pressures, but after 1,400 or 1,500 shots were fired at Cirie, the wear was already great and at the end of the firing considerable erosion had been produced at the origin of the rifling, whence resulted a falling off of 25 m. in velocity and an increase of 50% in the probable zones. These deteriorations, due to the use of ballistite with 50% of nitroglycerine in it, have also been noted with the Krupp and Schneider guns.

The resistance tests were in two parts; one before the road tests and the other after.

In the first, there were fired 160 shots in rapid salvos of 10 shots automatically or by hand; in the second, which took place January 12, 1911, there were fired 230 shots in rapid salvos, of which 130 were at 6,000 meters and 100 at 2,400 meters, while the carriage was in action on hard and frozen roads following a temperature of -14° Centigrade.

In these tests the cylinders functioned with perfect regularity, never failing to come back to battery and never producing a final shock; 1,300 shots were fired before the piece-cylinder was refilled. The spades held perfectly without any recoil, but 20 to 25 blows of the sledge were necessary to sink them 8 cm.

As for the automatic breech mechanism, it worked perfectly. At the 160th shot of the last series the breech-block did not open, but a little oil in the mechanism was sufficient to complete the firing without further delay.

The rapidity of automatic fire varied from 19 to 26 shots per minute according to the angle of fire. In fire by hand it fell off only two or three shots, provided the chief of section opened the breech.

In the endurance tests the board was surprised at the moderate heating of the recoil mechanism. This heating is distributed between the two coupled recoil systems, and the gun, distant as it is from the cradle, does not heat the carriage cylinder by radiation, as is the case with the present cylinders.

The board found that separation of the laying in range from laying in direction, and laying by the level, simplify to a marked degree the duties of the cannoneers and insure accuracy in rapid firing.

The duties of the three cannoneers at the piece itself are reduced to the following:

The left gun pointer maintains the sight in direction on the target.

The right gun pointer keeps the bubble between its marks and sets off the ranges.

The loader shoves the cartridge in and fires the gun.

The board, while admitting that the normal laying in elevation will be effected by levelling a bubble tube, so that the sheaf of fire remains entirely in the hands of the battery commander, demanded, nevertheless, the addition of a direct line of sight giving at the same time laying in elevation and in direction; to this end, there has been placed in the carriage cylinder a spring designed to push the piece into battery under variable inclinations. Under these conditions, the left cannoneer having at hand the handwheel on the trail for laying in elevation, and also the traversing handwheel, the panoramic sight forms the direct line of sight with independent range, this range being given by the right cannoneer.

The last five hundred shots, approximately, were fired under these conditions.

The road tests involved travel over 1,000 kilometers of the mountainous regions about Cirie and in the rocky bed or on the steep banks of the Stura. The materiel was found very mobile and solid.

In the passage of obstacles at all gaits, the board stated that the rigidity of the pole gave complete security to the drivers.

Before and after the road tests and after the final fire, the materiel was completely dismantled and minutely examined in all its

parts. The board discovered no evidence of wear or tear in any part of the mechanism, nor in any joint, except in a shield fastening. The wheels themselves were in perfect condition.

At the close of the tests at Cirie, the Italian government, at the unanimous recommendation of the board, ordered a battery of this system to make tests on a large scale in the service.

Observations.—The application of this system is not limited to field guns. It may also be extended to guns of all types and of all calibres. The guns on wheels with great vertical and horizontal fields of fire are under conditions similar to those which are placed on fixed platforms, but they have the immense advantage of mobility and a capacity to go into action at once.

The adaptation of this materiel to the French regulation projectile is being studied.

NEW GERMAN FIELD ARTILLERY FIRING REGULATIONS.

In March, 1911, a book prescribing new regulations for the conduct of fire was placed in the hands of the German Field Artillery. The principles governing the employment of field artillery announced in the Drill Regulations of 1907 have not been altered, the new regulations dealing solely with the conduct of fire. Nevertheless, the interpretation placed upon the 1907 regulations would seem to be somewhat modified by the adjunction of the new chapter.

The July number of the *Revue Militaire des Armées Étrangères* devotes an able article of over 10 pages to an analysis of these new firing regulations, and an exposition of the present state of German ideas regarding field artillery.

Indirect fire being now accepted as habitual and as efficient, an admission which the Germans have taken ten years to come to, modern artillery has got to devise the material and the tactical means of destroying these masked batteries. This has led the Germans to a belief in the usefulness of their 6-inch howitzer using percussion H.E. shell for field operations. This piece comes in where effects are not produced by the 4-inch mortar or the 3-inch gun. using time fuze H.E. shell.

The methods of fire-control using time fuze, until recently accepted, have been found too slow in adjustment. It seems to be decided that minute adjustment and some accuracy must be sacrificed to the necessity of rapidly getting an effect. Masked positions are accepted as the rule, made possible by a more careful preparation of the fire and by new and simple procedure for designating targets and for changing target.

The firing regulations are divided into three parts: (1) Generalities, relating to the trajectory, the effects of projectiles, and corrections required; (2) Principles of fire, preparation, observation, appreciation of heights of burst and distances; (3) Execution; fire for adjustment and effect, particular cases of fire.

In the discussion of effects of projectiles we find considerable new matter concerning the improved projectile for the 4-inch howitzer, the combination shell and shrapnel. The fuze for this projectile is of quadruple effect. It can be set in four different ways:

- (1) Time fuze shrapnel giving the ordinary shrapnel sheaf.
- (2) H.E. percussion shell bursting on graze.
- (3) Delay action percussion shell.
- (4) H.E. time fuze shell.

In the fourth case the cone of dispersion is of very wide angle, about 200°. The shrapnel bullets as well as shell fragments are projected forward, to the sides and to the rear. The efficiency of this shell thus bursting is nearly independent of the range used, but the burst must be fairly near the target, in front, above or in, rear. The dispersion in width permits a single shell to cover twice the front of a battery, very nearly, the total width being 150 meters.

Therefore, if this projectile does what is claimed for it, the 4-inch howitzer must be considered as a most valuable weapon for attacking defiladed batteries, especially those *whose extent and location of front are uncertain*.

The regulations indicate that this projectile using timed H.E. shell will be used in zone fire with ranges increasing by 25 yards. The short limit of the fork being determined, zone fire is at once employed with the certainty of one salvo reaching the target, and that over a wide front.

This use of the light mortar for the destruction of those sheltered batteries whose fire it is most necessary to silence has produced a current of opinion looking toward the increase of the number of these pieces in each army corps from 18 to 36.

The new regulations count also, though in a minor degree, upon the efficacy of time fuze H.E. shell fired from field guns, against sheltered batteries.

The time of bursting of the fuzes for these shell has been carried from 3,600 to 5,500 yards.

Finally, the Germans count upon the intervention of their 6-inch mortar against hostile batteries, whether masked or not, whose approximate location has been revealed by reconnaissance of the ground and against which the lighter guns have been ineffectual; but the perfecting of the projectile for the 4-inch howitzer has lessened the need of this intervention of such heavy material and placed it more in its ancient role. Nevertheless, the approaching increase in the foot artillery proves that there is no thought of decreasing the amount of heavy artillery that the Germans contemplate taking into the field.

The useful qualities of this heavy artillery are incontestable, but its cumbersomeness, its less rapid and less accurate fire, and the space it takes in column are no less apparent. Whether the German solution is the best no one can say but the importance of the measures taken and the tendencies revealed merit an attentive examination.

The second part of the Regulations, entitled "Principles of Fire," form an interesting study to those who wish to compare the adaptability of the German gun to modern fire problems with that of the French or American gun; but the organs of the German piece are so different from our own and, it seems, so inferior, that no particular instruction for us is to be gained by a minute study of their method of laying, correction and adjustment. Our own gun being adopted and no defects having been developed in the course of service, there is little profit to the general reader in seeing how another system of artillery accomplishes the same results. However, the author of the article under consideration gives a very clear description of the German system of laying for those desiring to understand it.

He also quotes a German publication of January, 1911, which states that "the presence at the last maneuvers of battery observatories, telephones and laying circles" (a species of B.C. telescope) "enabled the full utilization of the advantages offered by concealed positions. The resulting improvement is such that the last opponents of indirect fire are converted." In fact, the author finds that the prescribed "use of an aiming point for the six guns, and independent of the target, the employment" (in the battalion) "of a registration mark for indicating in millièmes the designation of any particular target, clearly show that German batteries can now form their sheaf on a reference point or target, and that they have at last recognized the advantages of the position of observation."

In the fire for range adjustment the new German regulations prescribe (Par. 95) that percussion fire shall only be used when the fire for effect is to be with percussion fuzes. Par. 100 seems to throw some doubt on this prescription, however. The adjustment with time fuze was considered as an exceptional proceeding in the regulations of 1907; it is now the rule as it has been for ten years in the French artillery.

The fire for effect against fixed targets is executed by volleys at successive ranges, which for shrapnel fire are 50 yards apart and for

shell fire 25. The initial range is always taken short of the inferior limit of the fork established, 100 yards in shrapnel, 50 in shell fire. Starting with the first round inferior by 100 yards to the short fork, volleys are fired at 3 ranges with shrapnel, increasing by 100 yards; at 4 ranges with shell, increasing by 50. With shell, volleys are later fired at the intermediate ranges at 25 yard intervals.

The adjustment for range and height of burst are in principle executed simultaneously, but it is effected using only one or at best two guns. When fire for effect is opened there are therefore 4 guns which have not fired. These have made the corrections indicated for the whole battery, but their individual direction has not been established and corrected, hence the sheaf can have no regularity when the fire for effect opens and delay would seem inevitable in producing a rapid effect where desired. This may be a defect inherent in batteries of 6 guns, unless ranging with all six is accepted.

Through fear of firing over the target, the opening range in fire for effect is taken as we have seen, at 100 yards short of the inferior limit of the 100 yard fork. If the target is really near the longer limit, the first three volleys would be ineffective (three ranges increasing by 50).

The German regulations prescribe no mechanical or automatic means of searching in depth, such as our zone fire.

The matériel has no automatic fuze setter.

The new method prescribed for time-shell fire corresponds to that used for shrapnel and is therefore a simplification, but it contemplates a large expenditure of ammunition: 7 ranges increasing by 25 yards, starting 50 yards short of the inferior limit of a 100 yard fork.

In firing against balloons or aeroplanes the 6 pieces are given ranges increasing by 100 or 200 yards; the modifications given the range are in general not less than 1,000 yards. Little effect can be expected without large expenditure of ammunition.

A considerable chapter is devoted to night firing, "which differs from day firing only in its preparation." Adjustment of fire is made in the day, if possible, if not then a wide fork is used starting from a range estimated by any means. "If the height of burst has not been adjusted by day firing it can nevertheless be effected with sufficient accuracy at night" (Par. 162).

If search lights are available firing can take place at night as readily as by day (Par. 163).

These of course are German views and there is nothing to indicate that they have had a great experience in night firing, with or without searchlights.

The duties of the battalion commander in combat are stated to be chiefly of a tactical order; he only exceptionally intervenes in the conduct of fire of a battery.

He puts the battery commanders in possession of facts as to the tactical situation and of the mission of the battalion. He organizes the zone of action of his battalion. If the regimental commander has not organized a system of communication with the firing line, he does so. He generally has the duty of establishing lateral observers.

The battalion commander chooses his post of observation and allows the captains to choose theirs, near or far from the batteries according to circumstances. He endeavors to keep near him one battery in order to direct its fire immediately upon an advantageous stopped). However, this last information and other must generally target.

"When telephonic communication is established the first care is to connect the batteries. After this is done connection may, if possible, be made with higher commanders or with lateral observers."

Increase in the rapidity of fire of one battery well provided with ammunition is often preferable to the concentration of several batteries' fire.

The author of this article then examines the present tendency of German tactics in what concerns the artillery. He finds that while the artillery duel of 1870 is no longer contemplated, the Germans have not wholly discarded the idea which governed that duel. It is true that positions of observation are prescribed, but there is not a frank acceptance of the ideas long prevalent in France and known as the principle of "economy of forces" applied to artillery.

The new prescriptions concerning *liaison* with the infantry are clear. This must be effected from the top and from the bottom. "The principal mission of the artillery is to support the infantry." (Par. 364). "Care must be taken to keep in constant communication with the first line of combat. Officers must be sent forward with this line who communicate to the rear by signals or telephone. They should especially indicate at what distance the friendly firing line is from the enemy, in order to let the artillery fire as long a time as possible." (When 300 yards from the enemy, time fuze fire is

come from the infantry itself, and it is not necessary that an artillery officer should be on the infantry firing line, where he would not be best placed for calmly observing and sending information to the batteries. One of the first duties of an artillery commander supporting advancing infantry is to send a capable officer to the commander of that infantry. Here all information from the fighting line comes and valuable indications can be sent to the artillery. Nevertheless, every artillery commander down to a battery commander must, on his own initiative, direct his guns on such objects as the situation demands.

ORGANIZATION AND TACTICS OF THE JAPANESE FIELD ARTILLERY.

GENERAL RICHTER, in *Artilleristische Monatshefte*, September, 1911. Translated for the *Field Artillery Journal*.

I.—*Organization.*

In the *Artilleristische Monatshefte* for November, 1910, were published a few notes on the organization of the Japanese artillery, taken from J. C. Balet's book, "Military Japan: Army and Navy in 1910." In *Mitteilungen über Gegenstände des Artillerie- und Geniewesens*, No. 6, are additional notes, taken not only from Balet's book, but also from Ursyn-Pruszynski's "The Japanese Army in 1910," which, in general, confirm our original information, and add to it certain points concerning heavy artillery and equipment.

Only two important changes are noted from our original information. The three independent field artillery brigades are made up of the regiments numbered from 19 to 24, inclusive, instead of 13 to 18, and besides the three mountain battalions of three batteries each, there are three independent mountain batteries, making with the six reserve batteries, 21 mountain batteries in all.¹

Our original notes said that the weight of the horse artillery gun would be between 1400 and 1500 kg., but that the experiments had not yet been completed. It appears that they now have been, and the gun definitely decided upon; details are given below.

All field batteries have six caissons each, three of which belong to the firing battery, and three to the battalion reserve. Each regiment has an ammunition column of 27 caissons, organized in three platoons of nine caissons each. One platoon carries only shell; its caissons are marked with a yellow band.

The first line ammunition supply is 211 rounds per gun, one-third of it being shell; 36 rounds are carried in the gun limber, 100 in the caisson, and 75 in the regimental column. Each division has three or four ammunition columns, of 46 caissons each, as a first reserve.

¹ This number evidently includes the three depot batteries; see note from *Deutsches Offizierblatt*, Aug. 24, 1911, in the *Field Artillery Journal* for December, 1911.—Translator.

Batteries are abundantly supplied with tools of all kinds.

Most of the light batteries are armed with the new rapid fire gun, Model 1905; but a considerable number still have the old Model 1898. The Model 1905 gun has a wedge breech block; the horse battery gun a screw block. Recoil is controlled by hydraulic cylinders and recuperator springs. Special brakes are provided to lock the wheels. The shields are 3.6 mm. thick. Two men can be carried on the axle seats, and three on the limber chests.

The mountain batteries have 75 mm. long recoil guns, but no mechanical and ballistic data are available. The transport of each gun requires five pack animals, that of its ammunition seven. Of the 42 ammunition animals in the battery, one follows each gun, 18 form an ammunition platoon, and the rest an ammunition reserve. Each battalion has an ammunition column of pack animals. Of the independent mountain batteries, two are in Formosa and one in Tsushima.

The strength of the heavy artillery is given as 28 battalions (according to Ursyn-Pruszyński, 12 heavy and 24 fortress battalions). Eighteen battalions are organized into six regiments, and four of these regiments into two brigades; the remaining two regiments and ten battalions are independent. Part of these are heavy field and part coast artillery. In war, two siege parks are organized; the coast battalions man the siege artillery, for which no peace organization exists.

Each battalion has three batteries, and forms a fourth in war. Upon mobilization, each regiment organizes two reserve battalions of two batteries each, and one depot battery.

Each heavy field battalion has one battery armed with 10.5 cm guns, Model 1906, and two with 12 or 15 cm. howitzers; all batteries are of four pieces. Peace strength is five officers, 120 men and 48 horses; in war, the strength is 170 men.

The 10.5 cm. guns, Arisaka 1906, are long recoil guns with screw breech-block, hydraulic recoil brake, and 4 mm. shields. The rate of fire is four shots per minute. They are drawn by eight horses and manned by eight cannoneers. The howitzers are of Krupp constant recoil type, but made in Japan. The 12 cm. howitzer requires six horses, the 15 cm. eight.

Two caissons are allowed to each heavy gun; in addition, there is a regimental column of 24 caissons for the 10.5 cm. guns. The organization and composition of the ammunition columns are not known.

The siege artillery uses 10.5, 12 and 15 cm. guns, 12, 15 and 28 cm. howitzers, and 15 cm. mortars. The newer guns are Krupp or Schneider.

DIMENSIONS, WEIGHTS AND BALLISTIC DATA.

	7.5 cm F. A. gun.		7.5 cm. H. A. gun.	10.5 cm gun.	Howitzer, Med. 05	
	M 1995	M. 1898			12 cm	15 cm.
Length, calibers.....	30	30	30	30	10	11
Weight of gun and carriage, kg.	901	835 (885)	852	2244	1097	2031
"..... limbered, kg.	1687	1638 (1650)	1400-1500	?	?	2535
Maximum elevation, degrees	29	19 (25)	16.5	35	42	42.5
Maximum depression, degrees	8	11 (5)	8	2	?	5
Height of axis of piece, m.....	0.7	0.9 (0.7)	0.7	?	?	?
Track, m.....	1.4	1.2	1.4	1.4	?	1.4
Weight of projectile, kg.....	6.5	6.5 (6)	6.5	22	20	35.8
Muzzle velocity, m.....	519	458 (490)	519	540	290	290
Maximum range, m.....	8400	8000	8400	9800	5600	6400
"..... for time fire, m.	7900	6400 (4300)	7900	8500	?	?
Number of shrapnel balls.....	210	234	210	530	575	945
Weight.....g.	16	10.6	16	?	?	?
Rounds in gun limber.....	36	40	28	0	16	12
"..... caisson with limber	100	?	74	36	32	24

(Note.—The figures in parenthesis are according to old reports. The 1905 field gun has maximum elevation as above, but the sight is graduated only to 18 degrees.)

Lieutenants of artillery are sent to the Artillery and Engineer School for a year; the best of them are retained there for a second year, at the expiration of which a few are selected for further instruction abroad. There is a Field Artillery School of Fire, with a course of eight months for captains and one of four months for field officers. The heavy artillery has a separate school of fire, with three courses—one of eight months for captains and first lieutenants, one of four months for field officers, and one of variable length for instructing officers and non-commissioned officers in the use of the electric lighting apparatus.

There is an inspector of field artillery and one of heavy artillery; both of these, together with the schools above mentioned, are attached to the inspectorate of special troops.

II.—*Tactics.*

The regulations of the Japanese field artillery, at the outbreak of the war with Russia, were very similar to the German, parts of

them being almost literal translations. The new regulations, published six years after the end of the war, still show very distinctly the influence of German models. The general arrangement is the same, although some parts are condensed and those relating to replacement of ammunition, personnel and materiel are omitted, and there is much less literal translation; there is some new material resulting from war experience.

Among the general principles, emphasis is laid upon the importance of unity of command to get the maximum fire effect; rapid and accurate fire, in violent, short bursts, is recommended. It is urged that the artillery shall put a superior number of guns in action but that where circumstances permit part may be held in reserve at the outset.

The battalion is the habitual tactical unit, although it is recognized that under special circumstances single batteries, or even single platoons or guns, may be used. Following the practice in the Russian war, preference is given to separate groups of guns rather than long lines; the reasons given are the same as in our own regulations.

A conviction is everywhere to be traced, that victory requires intelligent co-operation between infantry and artillery, and that the sole duty of the artillery is vigorous support. It is urged that it must, at all times, devote its attention to assisting the infantry in its work; in critical situations, or in carrying out special undertakings, it must not hesitate to expose itself to the heaviest rifle fire, and at the same time develop its own fire to the maximum, the shields giving protection against rifle fire even at close range. There is no detailed discussion of methods by which these requirements may be fulfilled, as in the French regulations.

Positions are classified as open, covered, and intermediate. The discussion of their relative advantages and disadvantages is very similar to that in our 1907 regulations; the conclusion is, that in many cases open or intermediate positions will be necessary, but that when circumstances permit cover is preferable. Much is left to the judgment of the immediate commanding officer; but it is definitely prescribed that cover shall be abandoned when the desired result can not be obtained otherwise, as at the crisis of the infantry attack. Positions to be used at such times should be prepared in advance.

In reconnaissance, use should be made of patrols and scouts, and time should be allowed for them to complete their work. These patrols as a rule march with the leading closed body in the advance

guard, and do not go out so far as we often think desirable. Commanding officers are cautioned not to send several patrols to do the same piece of work.

The artillery commander is required to remain, both before and during the action, in constant communication with the commander of the whole force, with his own subordinate commanders, and if necessary with other troops. It is his duty always to have a comprehensive idea of the whole situation on the battle field, and constantly send information to the places where it is needed, using whatever means of communication promises the quickest and surest results. Occupation of position and establishment of communication must take place simultaneously. This requirement that the artillery commander shall be in constant communication with the commander in chief does not seem, as in France, to mean that he must actually remain close to him; but rather that he shall be able at any time to exchange views with him as to the situation and the necessary action. As is more clearly explained later, in discussing the deployment of the artillery, the artillery commander's place is wherever he can best observe and direct the fire, or where he can most satisfactorily receive and send messages and orders.

Special escorts are not considered necessary for artillery, except at night, in fog, or under other exceptional circumstances. Protection is given by troops in front or on the flanks; in case of need, the nearest troops, of any arm, may be called upon for it. It is prescribed that if, in passing from march to combat formations, an assembly formation is taken while the artillery commander is making his reconnaissance, the senior officer present is responsible for the necessary measures for security; with us, this would be taken for granted.

Our own regulations are followed in the matter of entrenchments, and in the requirement that batteries which have expended their ammunition shall remain in position until resupplied.

In regard to firing over friendly troops, and night firing, the only requirement is that the other troops be not endangered. There is no limiting distance between infantry skirmish lines, as with us. It is suggested that in such cases the fire be from batteries in commanding positions or on a flank; a sound principle, of course, but not always practicable. The requirement that the artillery—not merely the batteries that happen to be favorably placed—shall concentrate all its efforts upon the point of attack "until immediately

before the infantry assault," may very easily cause losses among the attacking infantry, on account of the excitement of battle and the difficulty of observation at such a time. Possibly it is considered sufficient to leave it to the artillery commander to decide what batteries shall take part in this fire. Nothing is prescribed as to the target for the artillery when it becomes dangerous to continue firing over the infantry.

If the enemy gets into the battery, he is to be driven out by hand-to-hand fighting. "If worst comes to worst, each man should know that he must die beside his gun."

After the discussion of general principles, the use of mountain guns is taken up. Although the Japanese felt the inferiority of these guns to field pieces in the late war, still, in view of the nature of the country in their probable theaters of war, they have retained twelve batteries armed with them. They intend to take advantage of their mobility not only in mountainous or difficult country, but even on level ground, to approach the enemy unobserved; on account of their small size, they can make better use of cover, and offer a smaller target, than field guns. During the war such guns were brought up even to the skirmish lines, and are said to have done good service there; they were moved by hand, under cover of the kaoliang fields. Whether this could be done in more open country may be doubted; but in any case, mountain guns may well be able to reach positions that would be out of the question for field guns under hostile fire. At close range they may give good support to the infantry, provided ample ammunition is within reach and the guns are well protected. The Japanese must have mountain guns in any event, and hence they try to find ways in which they can use them on the battlefield. If they did not need them for other purposes, they would hardly introduce them for such uses.

In the chapter on occupation of positions, it is prescribed that the position shall be indicated to the artillery commander by the commander of the force, and that he shall then dispose his batteries according to the plans of the commander, the situation, his own orders, and the disposition of the other troops.

Positions, it is said, should be such that all requirements can be met and the maximum intensity of fire developed without moving. This broad generality is qualified by the remark, that it will often be impossible to find a position answering all requirements, and that the batteries must not be held back too long in order to search

for one. The general statement is apparently meant to describe an ideal position; or possibly it means that it should permit of meeting all probable requirements in one particular phase of the action. If it were meant to be taken in the broad sense, it would not be necessary to discuss changes of position at all.

Other things to be considered in selecting a position, such as care in getting the proper front, continuous or echeloned lines, and use of several tiers of fire, are treated almost exactly as with us. If it is expected that additional batteries may be brought up later, the front assigned to the first ones must be limited accordingly. Batteries must not be held in reserve too long; commanders of units so held back should make all arrangements for getting into position quickly and safely. No suggestions are made, however, for determining the proper time for sending in reserves.

If it is necessary to assemble the batteries before sending them into position, a suitable formation must be adopted and covered routes to the assembly point reconnoitered. In moving into position, cover should be utilized as much as possible, but not so much as to delay the action or lose an opportunity to injure the enemy.

No detailed instructions are given, as in our regulations, as to the method of giving orders for occupying position and assigning sectors of observation; it is simply prescribed that the artillery commander shall give his subordinates information as to the situation, the part they themselves are to play, and the positions of other troops. Both in attack and defense, orders for opening fire with the whole or any part of the artillery must come from the commander of the force. In the same way, under the heading "fire direction" the duties of the different artillery commanders are not specifically defined; they are merely required to supervise the fire of their commands, taking into account the general situation, and assigning new duties to the batteries when necessary.

As a result of the experience of the war, it is forbidden to fire except at a definite, clearly distinguishable target, or upon an area in which the enemy has been certainly located, and which can be distinctly identified by reference to registration points. Targets are to be selected according to their tactical importance, the object always being to assist the infantry.

The value of concentration of fire is emphasized, but it is remarked that in most cases this concentration will be impossible, without leaving part of the enemy's guns unmolested. The Japanese, like

ourselves, look for the best results from a combination of frontal and flank fire; the latter is especially recommended against men behind gun shields or similar protection. Whether the actual result in such cases will be up to expectation is uncertain; gun crews may be protected against such fire by properly placed caisson bodies, and troops in entrenchments by traverses.

Of the co-operation of light and heavy artillery it is only remarked, that the light guns should as a rule fire at targets which are more or less visible, and upon areas held by the enemy; the heavy guns at targets close behind or under cover, and to destroy material objects.

In other respects, this chapter is very similar to the corresponding part of our regulations. One thing more, however, is worthy of notice; in discussing night firing, it is suggested that it may be desirable for the purpose of encouraging friendly troops.

The principles laid down concerning changes of position are the same as those accepted by us.

In "general principles of the attack" it is said that the position selected should be such as to permit the development of a superiority of fire at the point of attack. This assumes that before the position is occupied, reconnaissance shall already have determined the direction of the decisive attack. The Japanese should not count on this in future; the attacker will in general have to wait for the issue of the preliminary engagement before making up his mind. Still, the long range of the guns will permit concentration of fire upon the point of attack, even if this is found not to be in the place originally supposed. Like so many other general principles, this one is limited by the requirement that, in so far as possible, dispositions should be made so that the greater part of the battlefield can be taken under fire at the same time. And there can be no question of the soundness of the requirement, that the initial position should be as close to the enemy as the situation will permit; this makes it easier to locate the enemy and observe changes in his dispositions, and also to follow the course of the infantry attack and give it proper support.

Fire should not be opened until the infantry advances, so as not to call the enemy's attention to it prematurely; on the other hand, fire should not be held so long as to give the enemy's artillery a chance to fire unmolested at our infantry while it is deploying.

It is to be expected that the defender will post his artillery under cover near the probable line of advance of the attacker, so as to

fire upon his troops while making their preliminary dispositions. If he can not do this, he will hold his fire until the attacking infantry advances and gives him a favorable target. In one of these ways the defender will be compelled to open fire, and then the artillery of the attack will get its opportunity to return the fire, and draw it upon itself. The only effect anticipated at first is a slight diminution in the accuracy and volume of the fire. Possibly the hope that the enemy will show part of his artillery early in the game is due to the Japanese theories of defense, which require that when the defending artillery is masked, part of it shall be so placed that it can be brought up quickly for direct fire upon moving targets. With proper practice in handling indirect fire, however, it should be possible to remain concealed until the enemy comes to close quarters or enters the dead angle; superior attacking artillery can not count with certainty upon silencing the hostile batteries until then.

In the chapter on "attack of a prepared position," it is suggested that a few batteries open fire to induce the enemy to disclose his position. This plan, which in the earlier part of the Russo-Japanese war succeeded in drawing hostile fire, will probably work in future only when the fire really does some damage. It has, besides, the disadvantage of disclosing the attacker's own position, if, as seems to be intended, these decoy batteries fire from the main artillery line, and not, as was formerly the rule, from a retired position.

The Japanese regulations are the same as our own in the matters of keeping down the hostile artillery fire and drawing it off from the advancing infantry, fire upon the infantry of the defense, concentration of fire upon the point of attack, and keeping down hostile machine gun fire.

In the late war, on account of the superiority of the Russian gun, the Japanese artillery took position at long range and did not accompany the infantry attack, so that the sister arm had to encounter excessive difficulties and suffer excessive losses. When a position was captured, the batteries, if they came up at all, were late, so that they could not aid in the pursuit by fire, and full advantage could not be taken of the victory. The regulations now change all this. As already remarked, they require the first position to be as near the enemy as possible, so as to remain in close touch with the infantry. They also require batteries to accompany the infantry to decisive range, explaining that, while these batteries

may be lost, they will have served their purpose in encouraging the infantry. On this point it might be remarked that the destruction of a battery might have diametrically the opposite effect on the infantry. If positions are selected at the edge of the zone of effective rifle fire, and the selected batteries given time enough to reconnoiter the approaches thoroughly, the advance should not be so desperate an undertaking, and they should furnish powerful support to the sister arm. It ought to be perfectly practicable to get in to a range of 2000 or 1500 meters; and fire from here will probably be more effective than at shorter range, for the men will be cooler.

But the Japanese do not stop with this; they require that some of the guns be sent up close to the skirmish lines, to keep the enemy to his cover and so permit the machine guns to get into position and the infantry to close in. To us this requirement appears too great. The machine guns can find positions well to the front without any help; and the guns thus sent forward will be at once immobilized, and very soon silenced. It would seem that the Japanese idea is to use mountain guns in this way.

The use of artillery in the assault, in holding the captured position, and in pursuit, is treated as in our regulations.

The obstinacy in holding onto every inch of ground, so characteristic of the Japanese, is illustrated in the requirement that, if the attack fails, the infantry must remain in contact with the enemy until help comes to enable it to renew the assault. This help is looked for, in the first instance, from the artillery, which is to fire with the utmost vigor upon the enemy as he advances to the counter attack. The Japanese have demonstrated that they are capable of holding on in this way, and the regulations are justified in establishing the principle; but whether the thing will be possible against an enemy who sees and uses his advantage is another question. For European nerves, it looks doubtful.

The discussion of the *rencontre* engagement is a miscellaneous collection of general tactical principles, among which the specific part to be played by the artillery is not very clearly expressed. The chapter seems to have been inspired by the German regulations, but the adaptation is not always happy. One requirement is that the artillery, when it turns out of the marching column to seek its positions, shall provide for its own security; how it shall do so is not stated. If, as is usually the case, it remains in close touch with the infantry, no special dispositions will be necessary; if it is farther

separated, it should be the business of the superior commander who designates the position to make the necessary dispositions for getting into it.

The chapter on "attack of a defensive position" treats also of "attack of a fortified position." The first part conforms very closely to our regulations, but goes more into detail as to the conduct of the artillery, and repeats some of the principles laid down under the general subject of attack. The general idea is to wait until all the units are ready, and then open fire at the order of the commander in chief, taking the hostile artillery as the principal target.

The second part adopts our theories also, but does not give so clear a picture of the proper procedure. The suggestion is here repeated, that single guns should be brought up to the skirmish line to flank the point of attack.

Unity of command for the artillery is required with exceptional urgency where field and heavy artillery are to act in co-operation. In this case the work is to be apportioned according to the principles of the chapter on "conduct of fire"; the most appropriate targets for the heavy guns are fortifications, especially at the point of attack.

The principles of defense are the same as ours; in certain points, however, elaborations are found.

The ground that is found available for use in counter attack must be covered by the guns; this point has to be considered in selecting positions. When the principal point is to gain time, fire is to be opened at long range to delay the enemy's approach. The Japanese materiel is well adapted to this use, since their field guns have a shrapnel range of 7900 m. The possible lines of approach are to be carefully registered, to provide against attacks by night or in thick weather. If no opportunity for a counter attack presents itself, the artillery must make an opportunity, leaving cover if necessary, and concentrating all its fire upon the critical point. If, before the commencement of the infantry attack, the enemy's artillery is found to be hopelessly superior, the commander in chief should order the fire suspended.

The principles of pursuit and retreat are the same as ours. The two subjects are treated in a single chapter. In retreat, great importance is attached to orderly movement; each commanding officer is required to keep his subordinates well in hand, and movements are to be commenced at a walk.

The chapter on horse artillery with cavalry differs somewhat from ours. The discussion of the use of these arms in battle is

omitted, and that of reconnaissance and cavalry engagements modified. It is suggested that it may often be desirable to place the artillery in position near the main road while the cavalry advances on the flanks. Our own regulations recommend that trains and reserves be sometimes left behind in a safe place before the action commences, so as to keep them out of the way; but the Japanese make this the rule, remarking that circumstances may make it necessary for the guns to fire to the rear. Nothing is said of the use of artillery in reconnaissance, to force the enemy to show his troops; nor of positions in readiness, with guns limbered. The reason for these omissions is not apparent.

The foregoing review shows that the Japanese regulations contain no novel or peculiar ideas, but follow our own very closely. This may be taken as a high compliment for our regulations. When they were issued, four years ago, they were generally admitted to be thoroughly up to date; since that time, however, field artillery has not stood still, and a new edition now would undoubtedly contain many changes.

The Japanese theories deal almost exclusively with attack upon an enemy in position, as would naturally be the case after their experience in the late war. They assume that, as in that war, it will be possible to determine by reconnaissance the precise dispositions of the enemy, plan an attack deliberately, and carry it through systematically. An active, energetic enemy might disappoint them here. They may also find it an unsafe assumption, that their advancing infantry will compel the enemy to show his guns early enough in the action to permit their own artillery to silence them; the enemy's guns may be able to reach the infantry from entirely concealed positions, and show themselves only when the decisive attack is developed. As a rule, fire can not be drawn by decoy batteries. The only thing that can win is co-operation between the infantry and artillery, to be realized through proper dispositions on the part of the commanding officer and tactical training of the subordinates. This conviction, it is true, is clearly to be traced in the regulations, but the practical application of it might have been better explained.

The necessity of a sufficient ammunition supply is mentioned in several places, but no details are given; possibly special orders exist on the subject. At any rate, in the late war, the Japanese always succeeded in getting the necessary ammunition; the long intervals between the great battles helped them here.

Heavy artillery does not seem to be used to the same extent as in our army. The equipment includes 10.5 cm. guns and 12 and 15 cm. howitzers, which, if mobile enough, should be of great value against hostile guns. Only in the chapter on the defensive is this definitely prescribed—that the heavy guns shall engage the attacking artillery, leaving the field artillery to deal with the infantry.

The salient point in the regulations is the offensive spirit that pervades them, and the obstinacy demanded in holding on to any advantage once gained.

THE PROBLEM OF CLEARING THE MASK.

By LIEUTENANT SHERMAN MILES, 3D F. A.

An officer, having found an otherwise suitable position for field guns, is almost always confronted with the problem of clearing the mask. The Drill Regulations say that this problem should be solved before the arrival of the guns. The problem will appear in one of the two following forms:

(1) For a given position to determine the minimum range (with the angle of site appropriate to the terrain) at which the guns could fire and still clear the mask.

(2) For a given target to determine the position of the guns behind the mask from which they could clear the mask.

This problem is discussed in paragraphs 440-45 Provisional Drill Regulations, 1911. The method there employed in its solution is that of the sliding scale of the B.C. ruler. This method is often difficult to use, or, if used, is insufficiently accurate, because of the difficulty of determining one important factor of the proportion—the distance from the guns to the mask. Suppose, for instance, that the mask is a gently sloping crest within 100 yards of the guns. To use the sliding scale we must know the distance from the guns to the top of this crest. It is often difficult to locate this exact point; but even if we do locate it, and apply the sliding scale method, nothing more is determined than that the guns will or will not clear that particular point. If they do clear it there may be another slightly lower point nearer the guns which may touch or be above the curve of trajectory. To the solution of the problem in this case, then, the sliding scale method is not in practice applicable.

The following method is particularly applicable to this common case of the guns being on the reverse slope of a slightly convex hill. The two factors considered are—

- (a) The angle of departure of the projectile.
 - (b) The angular height of the mask above the guns.
- (a) must be greater than (b) in order that the projectile may clear the mask.

If, as in the first form of the problem, we wish to find the minimum range, (b) is first measured. The value of (a) is then established, since it must be slightly greater than (b). And, since (a) is equal to the algebraic sum of the angle of site and the elevation of the gun due to range, the elevation due to range is determined

for any given angle of site. By reference to a table showing the elevations for all ranges the minimum range is obtained.

If, as in the second form of the problem, the target is known, and we wish to find a position from which the mask can be cleared. one or more positions are tried. The practicability of clearing from any trial position is determined by measuring (b) and finding (a) by adding the angle of site of the target and the elevation corresponding to the range to the target. This elevation is taken from the table spoken of above. The angles (a) and (b) having been determined, the guns will clear the mask from that trial position if (a) is greater than (b), otherwise not.

Now, as to the method of measuring these various angles, and the form in which they should appear. It is easy to construct a table showing for all ranges the angle *in mils* of elevation of the gun due to range (with normal angle of site). The value of an angle in mils, divided by 1000, is approximately the tangent of the angle. This approximation is sufficiently close, especially for the smaller angles. For example, the tangent of an angle of 200 mils (11 degrees, 15 minutes) is 199/1000. No great error is made if we take 200/1000. The angle of site could similarly be easily put in tangent form by dividing the mils by 1000. The angle (b), being an angle of slope, could easily be measured in tangent form, as, for example, a slope of 1 on 20 from the guns to the top of the mask. Thus the three angles involved are readily put in the form of tangents, with a common denominator of 1000. If the reconnaissance officer carried a clinometer graduated in mils the problem would be simplified, and he would, moreover, be able to read angles of site far more readily and accurately than by any instrument at present issued.

How would this method of determining the practicability of a mask work out in the field? Let us imagine the typical case of an officer sent out to find a defiladed position to fire on a given target. He finds several positions, each more or less fulfilling the requirements of defilade, good range, accessibility, etc. He decides to examine them in detail, beginning with the one that seems the most promising. This position offers a flash defilade on the reverse slope of a slightly convex crest. He wishes to determine whether or not the guns can clear the crest. He carries a clinometer graduated in mils, and, on the case of the clinometer, a table showing the elevations in mils due to range. He first goes to the top of the crest and there verifies his first estimate of the range (he would have to do

this in any case). Looking at his table he finds the angle 130 mils opposite his determined range of 4000 yards. With his clinometer he measures the angle of site to the target—minus 5 mils. He corrects this for the position of the guns 4 yards below and about 30 yards to the rear—say minus 4 mils. Going to the proposed position of the guns he holds his clinometer at the height of a gun above the ground and measures the angle to the top of the crest—120 mils. Then—

$130/1000 - 4/1000 = 126/1000$, and is greater than $120/1000$. He sees that the guns would just clear the crest—for safety they had better be moved a little nearer. He is also able to give the battery or battalion commander the correct range and angle of site.

It will be observed that unless the angle of site of the target is greatly above or below the normal the officer will make no appreciable mistake if he does not stop to correct the angle of site measured from the top of the crest.

THE FIELD ARTILLERY OF THE UNITED STATES ARMY

ITS ORGANIZATION AND TACTICAL USE.

A LECTURE DELIVERED AT THE ARMY WAR COLLEGE BY LIEUTENANT COLONEL JOHN E. MCMAHON, GENERAL STAFF.

In this paper it is proposed to describe the organization prescribed for the field artillery of our Army in time of war and to give a brief resume of the general principles now generally accepted as to the tactical use of that arm in battle. It is assumed that officers of the other arms whose rank and training will, in case of war, bring them the command of the higher units or cause them to be selected as chiefs of staff for the more important subdivisions of a field army, have no concern with the technical details of the field artillery, but should, on the other hand, possess such a knowledge of the basic principles governing the use of that arm in battle and of the powers and limitations of the rapid-fire field gun, as will enable them to use it intelligently and obtain from it all the help it is capable of giving to the other arms.

Organization of our field artillery.—The artillery component of a field army consisting of three divisions and an auxiliary division, is as follows:

	3"			3.8"			4.7"			4.7"			6"		
	Field Guns			Howitzers			Howitzers			Field Guns			Howitzers		
	Battalion	Batteries	Guns	Battalion	Batteries	Howitzer	Battalion	Batteries	Howitzer	Battalion	Batteries	Guns	Battalion	Batteries	Howitzer
1st Division	3	9	36	1	3	12	..	..	..	..	..	..	..	..	..
2nd Division	3	9	36	1	3	12	..	..	..	..	..	..	..	..	..
3rd Division	3	9	36	..	..	..	1	3	12	..	..	..	..	..	..
Auxiliary Division.....	..	..	...	..	..	..	1	2	8	1	2	8	1	2	8
	9	27	108	2	6	24	2	5	20	1	2	8	1	2	8

To each of the first two divisions are assigned two regiments of field artillery, having thirty-six 3-inch guns and twelve 3.8-inch howitzers; the divisional artillery of the third division has thirty-six 3-inch guns and twelve 4.7-inch howitzers.

The artillery of the auxiliary division consists of one regiment made up of three 2-battery battalions equipped with 4.7-inch guns and

4.7-inch and 6-inch howitzers. This makes a total of 108 guns and 36 howitzers for the first three divisions, with a heavy artillery reserve of 8 field guns and 16 howitzers with the auxiliary division. The introduction of the field howitzer as a regular part of the divisional artillery is in keeping with the latest practice, their curved fire and heavy projectiles being especially effective against shielded artillery and troops concealed in trenches.

The regimental organization provides for the necessary scouts, agents, telephone and signal details, and is such that by the addition of 40 men per battery the field artillery can be placed on a war footing. For the ammunition supply of each division there is to be furnished an ammunition battalion made up of 3 batteries, each battery containing 24 caissons, 1 battery wagon, 1 store wagon, and the necessary men, horses and spare matériel to refit the fighting batteries as their losses occur.

Matériel.—The work of equipping our field artillery with the modern matériel was begun at the psychological moment when the appearance of the French rapid-fire field gun had startled the military world, and when a war between two first-class powers obligingly furnished an opportunity for testing the new methods and principles. This work has been carried on during a period of seven years with the result that, at the present time, our matériel is the equal of that supplied to the field artillery of any modern army. The equipment is now complete and includes an up-to-date rapid-fire gun, reliable ammunition, panoramic sights and other instruments for the conduct of fire, high-power telescopes and field glasses for the observation of fire, and field telephones, megaphones, reel carts and signal apparatus for maintaining communication from the artillery brigade commander, through regimental and battalion commanders, down to the batteries. We have been the first to adopt for our field gun the high-explosive shrapnel—the so-called "unit projectile"—thereby greatly simplifying the question of ammunition supply.

Characteristic properties of rapid-fire field artillery, and tactical principles based thereon.—As a preliminary to the discussion of the proper use of artillery in battle, it is believed advantageous first to enumerate the characteristic properties of that arm and then to deduce therefrom the tactical principles which should govern its use in war.

The principal characteristics of rapid-fire field artillery are as follows:

1st. It possesses great power of destruction, even at long ranges, against animate objects in the open.

2nd. It is able to produce this destruction in a short time and without its presence being suspected; it can act, therefore, by surprise.

3rd. It preserves its powers of offense, even when its personnel cannot see its targets.

4th. It preserves its liberty of action, even after opening fire, by reason of its ability to fire from masked positions.

5th. Its powers of resistance are greatly increased by the introduction of shields, which protect the personnel against small arm and shrapnel fire.

On the other hand, artillery is extremely vulnerable, despite its shields, if exposed to accurate percussion fire; if caught in mass in the open or while occupying a position; if surprised in column of route; or if attacked by cavalry or infantry on its flanks or rear.

Moreover, although a battery in the open, once it has safely gotten into position, is able to retain its position and keep up its fire under hostile artillery or infantry fire, it cannot change position, but is practically pinned to the ground as long as the enemy's fire remains effective.

Heavy field artillery has the same general characteristics as light artillery, except that it is less mobile, its preparation of fire and changes of target are slower, its projectiles are heavier but fewer in number, and its fire is more curved.

The principal tactical consequences resulting from the above properties are these:

1st. Artillery will occupy by preference masked positions, because in such a position it preserves its powers of offense and liberty of action, can act by surprise and is less liable to destructive losses. This rule, however, is subject to the general principle governing the selection of artillery positions, namely: that the guns must always be posted so as to be able to carry out effectively the task assigned them. If guns are posted in the open, they should, if possible, be protected by the fire of batteries in masked positions.

2nd. During an engagement changes of position should be ordered only when, by such changes, positive and well-defined advantages will be obtained. Owing to the long ranges at which modern artillery is effective, nothing is gained in the general case by slight changes in position, whereas during such changes the infantry is

temporarily deprived of the assistance of the guns and the artillery itself is exposed to danger of destruction while making the change under fire. An example of a positive advantage to be gained by change of position is when a position for flank or enfilading fire is thereby secured.

3rd. The result of the struggle between opposing forces of artillery will generally be indecisive. This is due to the fact that the use of masked positions and of shields make it extremely difficult to inflict destructive losses. If the enemy's fire becomes very effective, the battery commander can shelter his personnel behind the shields and await a favorable opportunity to intervene again in the action. The infantry should always bear in mind that silent artillery is not necessarily beaten artillery.

4th. Artillery fire will be continuous or intermittent, slow or rapid. The rate of fire will depend upon the nature of the target and the tactical situation. Rapid fire will be by short bursts or *rafales*, as it would be impossible to supply ammunition enough to keep up a continuous rapid fire.

5th. The consumption of ammunition must be most carefully watched. A *rafale* of zone fire consumes 32 rounds in about 40 seconds; it is therefore plain that the greatest care must be exercised that ammunition is not thrown away on unimportant targets and that the guns shall cease firing as soon as the definite task assigned them has been accomplished.

6th. Artillery on the march and also in battle depends upon the other arms for its security. Artillery in column of route is most vulnerable; in battery, it can generally defend itself against a frontal attack, but relies upon adjacent troops of the other arms to protect its flanks and rear.

Relations to be established between the superior commander and his chief of artillery.—Before taking up the subject of the proper use of field artillery in battle, based upon the tactical principles enumerated above, it would be well to clear up a matter which at present is not very well defined, but which has an important bearing upon the success of our troops in campaign. I refer to the relations which should be established between the commander of the troops and the officer acting as the chief of artillery.

The artillery understands perfectly well that it is an auxiliary arm. The first paragraph of the new edition of the Field Artillery Drill Regulations states:

"The sole reason for the existence of field artillery is its ability to assist the other arms, especially the infantry, upon the field of battle."

All it asks is that it shall be allowed to give the full measure of that assistance, and at the same time not be called upon to perform tasks that are beyond its power. To this end it is necessary that there should be a complete understanding between the superior commander and his chief of artillery as to the precise functions of the latter. It is acknowledged both in the business and the military world that the best administrator is the one who first makes up his mind what he wants to do, then allots to each subordinate his appropriate task and holds him responsible for success or failure. The subordinate, on his part, must be prepared to carry out the technical details of the part assigned him, and at all phases of the engagement be animated by a loyal desire to bring to a successful issue the plans of his chief.

Applied to the case in point, this principle requires that the superior commander, having determined upon his general plan, should make it known to the chief of artillery, especially explaining to him where the decisive attack is to be delivered and the part the artillery is expected to play in that attack. He should give due weight to the recommendations of his artillery staff officer as to the position to be occupied by the guns and as to the number of guns to be assigned to each particular mission. It is of the utmost importance, also, that the chief of artillery be kept informed of the progress of the action and of any change in the general plan made necessary by the developments of the action. It is with this purpose in view that the Drill Regulations require the chief of artillery, when called away by his duties from headquarters, to leave behind an artillery staff officer, with some mounted orderlies, for the intelligent transmission of important orders or information. If it be necessary for the chief of artillery to establish his station during an action at some distance from headquarters, communication should be maintained by a Signal Corps wire.

While, in the general case, the establishment of the proper relations between the superior commander and his artillery staff officer will secure the harmonious and effective working of the machine, there are two special cases where friction is likely to occur, unless a proper basis of action is established by the commander of the troops. The first case may occur when part of the artillery of one

division is assigned to another, in order to assist in the accomplishment of an important mission. The order making the assignment should clearly state in whom the command of the entire artillery force is to rest. In the general case it is most advisable to place all the guns at the disposal of the division commander and to entrust their immediate control to his chief of artillery. The same rule should apply when the heavy artillery of the auxiliary division is assigned to aid in the accomplishment of some particular task entrusted to a subordinate commander.

The second case concerns the question of ammunition supply. The chief of artillery is responsible for the replenishment of the artillery ammunition and is required to keep himself informed, at all times, as to the amount available in front of the advance supply depot or wagon head. When this supply is running dangerously low, he should have the authority of the superior commander to regulate its consumption. It was the lack of a proper understanding on this subject that caused the well known controversy between Generals Hancock and Hunt at the Battle of Gettysburg. Fortunately for the fate of the Union cause, the latter succeeded in having the useless artillery duel stopped, and enough ammunition was saved thereby to enable the guns to play an important part in the repulse of Pickett's charge.

Historical .— It may be of interest to the class to follow the evolution of the principle that now controls the tactical use of the guns in battle. It has long been a subject of common remark that for a few years following the end of a war the methods pursued by the successful party are rather blindly accepted as the only right ones. This is particularly true of the years that succeeded the last conflict between France and Germany. The startling success of the German surrounded all that they did with a sort of halo and caused the military world to overlook the fact that perhaps a part of this success was due to the unprepared state of their adversary. Hohenlohe was looked upon as the artillery Moses and his dictum that a battle should always be opened with a duel between the massed guns of the opposing forces was accepted without question. This principle, however, received a rude shock in the Russo-Turkish War, particularly at the third battle of Plevna. In this action the Russians bombarded the Turkish position continuously for four days and then advanced their infantry; the Turks, abandoning their redoubts during the artillery duel and seeking shelter in the

hollows of the adjacent ground, promptly manned their trenches when the Russian infantry appeared and drove them back with a loss of 365 officers and 18,000 men. This battle furnished one of the many proofs afforded by the war that good infantry cannot be shot out of their entrenchments by artillery and showed clearly the uselessness of the artillery duel. The final blow to the German idea was delivered when the French produced their rapid-fire field gun equipped with shields, thus affording almost complete protection for the personnel against artillery fire. The French school, headed by General Langlois, who may fairly be regarded as the father of modern field artillery ideas, laid down the following basic principles:

1st. Owing to the use of masked positions and shields, the struggle between opposing forces of artillery will generally be indecisive.

2nd. The fire of high-power field guns is ineffective against troops in trenches, provided these troops do not show themselves.

3rd. To force the enemy's infantry to man its trenches and thus furnish a target for the artillery, our own infantry must begin its attack before the question of artillery supremacy has been definitely settled.

In other words, the action of infantry and artillery on the battlefield must be reciprocal; the infantry advances in order to cause the hostile infantry to show itself, while the artillery endeavors to smother the fire of the enemy's guns, to inflict losses on the troops in trenches, to shake their morale and to cause them to deliver an ineffective fire. The correctness of these views has been tested in the recent war in Manchuria; and it may be said that the success of the Japanese arms was principally due to the fact that they were clever enough to realize the value of the new ideas and bold enough to try them out against a formidable adversary. These principles are embodied in our Field Artillery Drill Regulations.

The tactical use of field artillery in battle.—In the following brief discussion of this rather extensive subject, an attempt will be made to outline the general course of action of the artillery in a combat of *rencontre*, rather than to lay down general rules which must necessarily vary with the changing conditions of the action.

The artillery of the advance guard will, of course, be first engaged. Its commander should seize at once the most favorable position for the artillery of the main body and proceed to develop, by fire, the strength and position of the enemy. His principal duty is to support

the advance of his own infantry and to check the enemy in case of a repulse. The close support of his own infantry will require a considerable amount of mobility on the part of the advance guard artillery; batteries will be hurried forward or drawn back, as the result of the success or failure of the infantry, until the line upon which the main action is to take place has been approximately determined.

During the course of the advance guard engagement the army commander will have decided whether a general action is to be fought, and, if he decides in the affirmative, will cause the necessary reconnaissance to be made. It is at this point that there should be established between the superior commander and his chief of artillery the complete understanding so essential to success. The commander makes his plan, indicates the different missions to be accomplished, designates the troops for each particular task and regulates, as far as possible, the order of the different attacks. The chief of artillery having learned the objectives assigned to the infantry, what troops are told off for the accomplishment of each mission, the degree of importance of the different attacks and the order in which they are to be executed, assigns to their tasks the batteries at his disposal. He designates the battalions that are to support each attack, those which are to be held in observation or readiness, and determines whether any part of the guns can safely be left out of action temporarily, for use at the decisive moment of the main attack.

The artillery of the main body is moved up by order of the superior commander. It is generally agreed that in the normal case the guns should be brought up before the infantry of the main body arrives on the line. The reason of this is that the period of the occupation of the position is now regarded as the most critical of the whole action for the artillery. If caught by hostile fire while approaching its emplacements, the mass of guns, caissons, men and horses would suffer destructive losses, and the personnel, in addition, would be so shaken in morale as to be rendered useless as combatants for a considerable time. Priority of occupation of position is therefore to be sought. The guns, when brought up, need not necessarily open fire. Some of them will remain in observation; i. e., they will prepare all the elements of fire for the zone assigned them and be prepared to open an effective fire quickly on any targets appearing in that zone. It is during this move to the front of the artillery that its training in marking the route will

be found valuable. By the use of the scouts and agents attached to regimental and battalion headquarters, the route should be plainly marked so that each unit may promptly reach its designated position.

While in the normal case the general action is no longer opened by a duel between the opposing forces of artillery, it may happen that a definite artillery preparation will precede the forward movement of the infantry. This will be especially necessary in the attack of positions protected by stone walls, of villages in which stone or brick houses have been occupied, or of farms in which stone buildings have been put in a state of defense. In these cases it is the duty of the artillery to break down the material obstacles by high explosive shell fire. In most cases, however, the action of the infantry and of the artillery force assigned to its support will, as before stated, be reciprocal. Before the attack is begun it is essential that a definite understanding should be had between the commander of the troops and the artillery commander as to the object of the attack, the plan to be pursued and the part of the enemy's line where the greatest resistance is to be expected and where, therefore, the artillery's help will be most needed. Arrangements should be made to keep up communication between the commander of the attacking line and of the artillery support by telephone, courier or flag signals. Ordinarily the artillery commander will send a staff officer, with some trained scouts or agents, to accompany the attack and see that the instructions of the commander of the troops are promptly sent back to the artillery. As the attack proceeds the artillery commander ought to know especially the position of the enemy's troops that are causing the most trouble to the advancing infantry and when the artillery fire should cease for fear of striking its own troops. This last question is one for the infantry itself to decide, but it should always be decided by the man responsible for the success or failure of the attack, and not by some subordinate.

Following the general rule that the guns select as their principal target whatever is most dangerous to their own infantry, the artillery will at first be engaged with the enemy's artillery. It has hitherto been customary to assume that, previous to the attack, the artillery will be divided into two classes, the so-called "infantry batteries" or those told off to support the infantry advance, and the "counter-batteries," whose object is to neutralize the fire of the enemy's guns. While these terms are convenient ones for use in text books, it is

now generally agreed that no rigid distinction can be made in practice between the two classes, for the simple reason that no one can foresee, before the action begins, just how many guns will be needed to dominate the enemy's artillery and what proportion will be required to sweep the hostile trenches. In assigning the guns to their different missions, the artillery commander should follow the general principle of the economy of forces; he should not unnecessarily expose his strength but keep at his disposition a number of batteries in observation ready to intervene as the necessities of the action require. His first effort will be to dominate the enemy's artillery; if he does not succeed in this—and he generally will not—he will bend every effort to shake their morale, silence them temporarily and keep them so busy replying to his fire that they cannot concentrate against the advancing infantry.

The guns told off to support the infantry in their advance have one main purpose to accomplish—to sweep the enemy's trenches with a storm of fire, thereby shaking the morale of the occupants, preventing them from delivering an effective fire and raising in front of them a cloud of smoke and dust under cover of which the attack may advance. To do this they will cover with *rafales* of rapid fire the rushes from point to point, slowing down to continuous fire when the infantry lie down preparatory to another advance. This description applies, of course, only to the general method to be followed, and does not imply that the advance is made with that ease and rapidity that we have all noticed in maneuver camp problems, and which result from the comforting knowledge that only blank ammunition is being used. As the advancing infantry approaches the point from which the final rush is to be made, the guns are worked to their limit. "The attack is above all a brutal task," say the French Field Artillery Regulations, "a task to be accomplished by force rather than by address. Upon the point where the main attack is to be delivered the artillery commander should not hesitate to converge the fire of the greatest possible number of batteries, especially combining frontal fire with reverse and flank fire." At this stage of the attack especial attention should be given by the artillery to the enemy's machine guns. When the artillery fire becomes dangerous to the advancing infantry, as indicated by a message or signal from the infantry commander, the artillery should increase the range and endeavor to strike the reserves that are being brought up to resist the final rush.

As the attack approaches the critical stage, the artillery commander should have in readiness a number of batteries, preferably selected from those not deeply involved in the action, which are to be hurried forward at the instant it becomes apparent that the attack has succeeded, and at once placed in position on the ground taken by the infantry. These guns should conduct the pursuit by fire, drive back any return attack of the enemy and assist the advance against other positions on the line by a flank or enfilade fire. If our infantry is driven back the heaviest possible fire should be concentrated on the enemy as soon as such fire becomes safe for our own troops, to prevent an offensive return and to assure the retiring infantry that help is still at hand.

The question of the so-called "accompanying batteries" is a more or less delicate one to handle, in view of the opinion that prevails in some quarters that the field artillery is too prone to fight at long range. In discussing before the War College class the question whether or not batteries should accompany the infantry in its advance to the attack, it is taken for granted that soldiers of mature judgment will agree that the officer who exposes his men to destructive losses unless such exposure is absolutely necessary is as great a menace to the success of an army as the one who runs away. It may be said, then, that in the normal case the artillery will not move forward but will accompany the infantry *by fire*. In considering this question, the infantry should remember that during the time spent in changing position they are deprived of the assistance of the guns; that a change in range of 500 or 1000 yards causes but a slight increase in accuracy of fire; that the movement of artillery in mass across open ground that has already been registered by the enemy's fire is almost certain to result in putting it completely out of action; and that, even though a battery should succeed in getting into position under close artillery or infantry fire, it is thereafter pinned to the ground and must be abandoned to its fate if its supporting infantry is driven back. If, however, it be found that the close support of the guns will materially help the infantry in their arduous task, the artillery commander should never hesitate to make the sacrifice. This necessity may arise, for example, when by a forward movement a position may be reached from which the enemy's line may be swept by flank or enfilade fire; when a specially difficult target is encountered; or when the closer support of the guns will stiffen the wavering morale of the infantry and encourage

them to make the final effort necessary to win. In executing such a forward movement the artillery must take advantage of all available cover, move at a fast gait and, if time admits, cross particularly dangerous ground a carriage at a time.

Artillery in the defense.—The two main objects of the artillery of a force acting on the defensive are: 1st, to cause the enemy's infantry to deploy at long range, and, 2nd, to assist in the repulse of the attack by inflicting severe losses as the advancing infantry approaches the position held by the defense.

To cause the enemy's deployment at long range it will generally be sufficient to use a small number of batteries covering a wide front with their fire. The other batteries should at first be held well in hand and distributed later to meet the developments of the action. To prevent the premature disclosure of the position and strength of the defense, fire should, in general, be opened only by order of the superior commander. In front of batteries posted in masked positions, dead spaces are found, of greater or less extent, depending upon the degree of defilade taken; and these dead spaces should be covered by the fire of batteries posted on the flank. This is especially necessary for troops acting on the defensive, because while for the attack the question of dead space becomes of importance only when a counter-attack is delivered, the defense will surely be beaten if the attack is allowed to cross the ground immediately in front of the trenches, unhampered by artillery fire. These flank batteries should be thoroughly protected by traverses on their exposed side and be furnished with an ample supply of ammunition before the action begins. When once engaged they will with difficulty be supplied with help in men, horses or projectiles.

During the period which elapses between the deployment of the attacking infantry under the long range fire of the artillery, and the time when the mingling of the successive lines of skirmishers and the closing up of the supports and reserve produce a vulnerable target for the artillery of the defense, the mass of the latter will devote its attention to the hostile guns. As soon, however, as the attack becomes menacing, the guns of the defense must be used to drive back the advancing infantry. If the attack succeeds, the artillery should be withdrawn by echelon, the batteries posted in rear assisting the ones left in front to cover the withdrawal of the infantry. In the general case the order for the withdrawal of the guns should come from the division or higher commander. Guns

sacrificed in the attempt to save the retreating troops are considered to have been lost honorably.

The heavy field artillery.—As appears in the table giving the composition of the artillery component of a field army, it is not contemplated to have an artillery reserve. The Drill Regulations lay down the principle that the true reserve for the artillery is the ammunition train. To accomplish a mission requiring more artillery than can be furnished by one division, the necessary amount is taken from another division. In the regiment of heavy field artillery attached to the auxiliary division the army commander has a powerful weapon to be used when an especially effective blow is to be delivered. These guns and howitzers move slowly and time will be required to get them in position; but in an engagement of any magnitude the occasion for their employment will not ordinarily appear until the action is well developed, so that orders can be issued far enough in advance to have them on hand at the desired time. They will be found especially useful in reducing strong redoubts, in reaching with curved fire objectives sheltered in trenches and behind shields, and in the sudden attack of masses of infantry out of range of the light field guns. At the recent experiments with the new heavy field artillery at Fort Riley, the 4.7" gun, using 15 high-explosive shrapnel, inflicted a loss of 66 per cent on a column of 364 box targets representing a battalion of infantry in column of fours, at a range of 7,150 yards.

Night operations.—Movements of artillery to the front, made for the purpose of affording closer support for the infantry, will usually have to be made at night. To make this movement successfully the route should be carefully reconnoitered by daylight, the road carefully marked and the route from the point where the column leaves the road to the selected position picketed with men placed so close together that it will be impossible for the column to lose its way. Little effect may be expected from the fire of artillery at night, unless this fire has been adjusted while it is light enough to see the target. In this operation indirect laying is used and the data are verified by actual firing; by the use of an illuminated aiming-point, an effective fire can be delivered at night against the same target upon which adjustment was made. Effective use of artillery at night may be made to sweep a line of trenches, to prevent repairs on a field work or to prevent the enemy from passing a defile under

cover of darkness. Our field artillery is now equipped with proper sights and electric flashlights to deliver night-fire.

Conclusions.—In the foregoing incomplete outline of a broad subject, endeavor has been made to insist upon, as the first requisite for success, complete co-operation and understanding between the superior commander and his chief of artillery. In order that all friction may be avoided, whenever an extra force of artillery is assigned to assist in the accomplishment of a special mission, precise and definite instructions should be issued fixing the responsibility and command. The commander of the troops should formulate a definite plan, communicate it to his chief of artillery and make clear the function of the artillery in the working out of the plan. The artillery commander is thus made responsible for the execution of the technical details and for the proper distribution of the batteries at his disposition to carry out the plans of the superior commander. In this way, and in this way only, will the superior commander be left free to attend to the onerous duties imposed upon him in battle, and will it be possible to secure that smooth working of the whole machine which is absolutely essential to the successful accomplishment of his plans.

SPARTA, 1911.

BY CAPTAIN ROBERT H. TYNDALL, BATTERY A. INDIANA FIELD ARTILLERY.

Previous articles have been written regarding the schools held at Fort Riley, which were the first important steps toward the instruction of officers of militia field artillery. All efforts were there concentrated upon the technical duties pertaining to calculation of data, with some firing and tactical rides; it was assumed that all batteries were well horsed and all drivers well trained.

And here I might refer to reports that have been made, that "militia drivers can move their horses by team at a walk, provided the horses are gentle and the roads level." In my experience, both in volunteer and militia service, when occasion required, a battery could always move its carriages at an increased gait; not in the smooth way a trained regular organization would do it, but they could get the guns into position. We find that most militia batteries are horseless at home station; but it is well to continue to assume, at these schools, that they are well horsed, and go ahead with such instruction as is possible at this time. The horse problem will be solved in the near future, we hope.

The camp of instruction for militia field artillery on the reservation near Sparta, Wisconsin, September 1st to 30th, 1911, was the third that Battery A, Indiana Field Artillery, has had the good fortune to attend. At this camp everything pertaining to the instruction took a more complete form, and gave the officers and men an idea of what was to be expected of the organization as a whole, should it be ordered into the field for actual hostilities.

Program of the Camp.

September 1.

Arrival; making camp; assignment of horses. Talks to officers explanatory of course of instruction.

September 2.

Morning.—Officers: tactical ride; reconnaissance and selection of positions in solution of simple tactical problems, instruction in use of battery commander's rule and telescope, calculation of firing data. Enlisted men: harnessing, fitting harness, driving by pair, team and section, training of gun squad in fire discipline.

Afternoon.—Officers: firing data. Enlisted men: instruction of scouts and agents, stable duty.

September 3. Sunday.

September 4.

Morning same as 2d.

Afternoon.—Officers: adjustment of instruments; application of imaginary fire; determination of data. Enlisted men: driving; cannoneers in firing battery.

September 5.

Morning.—Battery mounted, all militia drivers and cannoneers; reconnaissance, selection and occupation of positions, posting limbers and reserves, calculation of data, adjustment of imaginary fire.

Afternoon.—Same as 4th; scouts, same as 2d.

September 6.

Morning, same as 5th.

Afternoon, service practice.

September 7.

Morning, service practice.

Afternoon, observing other batteries fire.

September 8.

Morning and afternoon, service practice.

September 9.

Morning, battalion service practice.

Afternoon, breaking camp.

Under the instruction of a regular officer, the officers of each battery were taken for tactical rides, selecting positions, computing data, simulating fire, changing targets, moving forward and firing at same targets from new positions, later taking position where the targets were and reversing the problem. A continuous problem would take up an entire morning, and good lessons would be learned by observing the ever-changing appearance of the terrain from different angles. During this time other officer instructors were working with the different units of the batteries. One had the drivers out with the limbers hitched, instructing in riding and mounted drill; another had the cannoneers in park; still another had scouts and agents working with telephones, establishing lines of communication and making and reporting on observations. This instruction was so thorough that battery commanders had to pay little or no attention to these men when the time came to take up tactical problems.

After about four days of this work, the batteries were ordered out under their own officers, with their own drivers and cannoneers, for

tactical problems and service firing. A few hundred yards from park a problem was given the battery commander, for example, as follows:

Situation. Hostile troops are moving toward Sparta from the east. Your own infantry occupies north and south line through Maul's Bluff.

Orders. Move forward at once, and assist your infantry by firing upon the enemy.

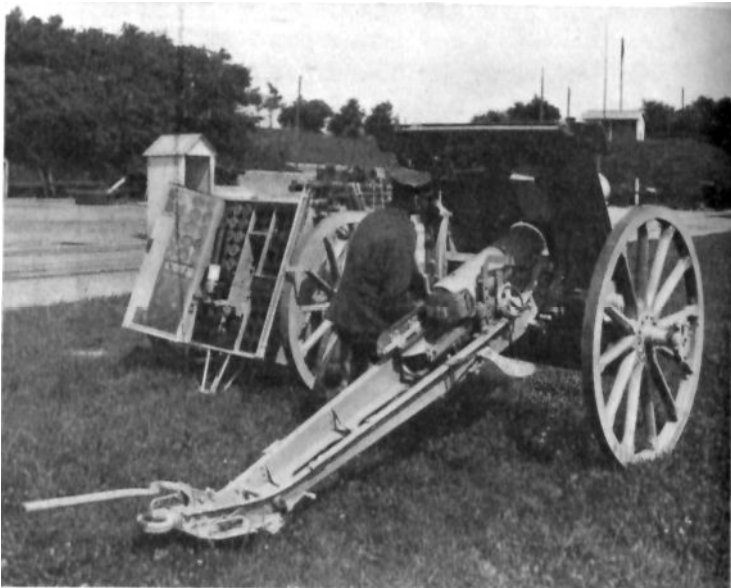
Then came the time for the organization to show the benefit derived from the instruction of the past four days. The battery commander, after having his executive officer read the order, turns the command over to him, designates a place for the reserve, and moves forward with his reconnaissance officer, scouts and agents, not only to reconnoiter for the enemy, but to locate his own assumed infantry. It is needless to tell those who have been over this ground that an officer is lost without his compass. He finds the target, selects good concealment for his guns, a safe place for the limbers, the best observation station available, and a well-defined aiming point. He then sends back for the battery, and spends the time in computing data and looking over the situation in general. The guns come forward over the designated trail under cover, and take position; and then comes the most difficult work for the battery commander,—observation and adjustment of fire. When the problem is complete the watch of the critic is stopped, your errors pointed out on the spot, and the whole problem talked over. Mistakes? Of course there were mistakes; if there were none, it would be a useless expenditure of time and money to hold these camps.

Some may say that the same problems, or others of the same nature, have been worked out at joint maneuvers before this. True, they have been attempted, and were supposed to have been solved. But at Sparta service projectiles were fired when the enemy was located, and all operations were under the eyes of competent instructors who were students of field artillery. This is quite a different situation from firing blank charges and being criticized by umpires from other arms of the service, and perhaps being ordered into unsuitable positions by higher officers who knew nothing of the powers and limitations of the three-inch gun.

I do not think it would have been wise to attempt so complete a program for the first two years of the Sparta camps; but following the instruction there and the schools at Fort Riley it was the consistent thing to do, to advance both knowledge and interest.

NEW RUSSIAN GUNS.

Since the Japanese war. Russia has been very active in rearming her artillery. This rearmament, now approaching completion, will give her what is probably the most complete, homogeneous and modern artillery materiel in existence. Two very characteristic guns of the new series, presenting features of special interest, have been selected for description here.



Schneider 75-mm. Horse Artillery Gun.

The first is the horse artillery gun, Model 1911, designed and built by Schneider and Co. It combines power with mobility in a very high degree, and permits of fire at an unusually high angle.

The caliber is 2.95 inches; length, 23 calibers; weight of projectile, 14 lbs. 5 oz.; M. V., 1770 f. s. The breech mechanism is of the usual Schneider type.—slotted screw, single motion. The recoil system is also of the standard pattern, with the valveless pneumatic recuperator, which, the makers say, "can no more leak air than a bottle half full of water, tightly corked, and turned upside down."

The sight is panoramic; direction and angle of site are given by gearing on the left side of the carriage, elevation for range on the right. The caisson carries a mechanical fuze-setter. Traverse is on the axle, three degrees on each side of the normal. The shields are large, and the openings in them small.

The most noteworthy peculiarity is the variable height of the axis of the piece. The axle-arms are cranked, and the trail U-shaped in cross-section; the cradle lies in the hollow of the trail. The axlearms may be



Schneider 11-inch Siege Mortar in Firing Position.

revolved, and fixed either at their highest or lowest point. In the lowest position, the height of the axis of the piece is only 31 inches, although the carriage is mounted on 52-inch wheels, and the center of gravity is very low; in the highest, the axis of the piece is raised about a foot, and the maximum firing elevation is increased from 17 degrees to 25 degrees, giving a maximum range of 7800 yards. The maximum depression is 8 degrees in the high position, 16 degrees in the low.

The weight of gun and carriage in firing position is a little under 2100 lbs. The weight of the piece limbered is not given; if the limber is similar to that of the Schneider 1908 horse artillery gun, it would make it between 2800 and 2900 lbs., fully equipped but without ammunition.

The other gun is the 11-inch siege mortar. This is, of course, in no sense a field gun, but is interesting as being, so far, the last word in siege matériel, and as showing what degree of power and mobility is now demanded—and supplied—in a purely siege weapon.

This also is a Schneider gun. With carriage and platform complete it



Schneider 11-inch Siege Mortar Ready for the Road.

weighs 33,000 lbs. The length of the piece is 12 calibers. Two types of projectile are provided.—common shell weighing 757 lbs., and high explosive shell weighing 605 lbs. The muzzle velocity is, for the former, 850 f.s.; for the latter, 1060 f.s., with normal charges. Provision is also made, by graduation on the elevating gear, for four other charges. The limits of elevation are from plus 10 to plus 60 degrees; of traverse, 10 degrees on each side of the normal.

The breech mechanism is a slotted screw with plastic obturator pad. The recoil system is the Schneider hydro-pneumatic.

For transport, four carriages and a store wagon are required,—one each for the piece, the top carriage, the chassis and the platform. The carriages themselves consist of little besides the wheels, axles and poles. The heaviest load is the platform wagon, 11,200 lbs.; the lightest the chassis wagon, 8700 lbs.

All the tools and accessories required are packed in the store wagon. An American artillery officer, who witnessed a test of this mortar last October, gives the following as the time required to dismount the gun and prepare for the road:—

	<i>minutes</i>	<i>seconds</i>
Gun wagon	9	15
Top-carriage wagon	7	42
Chassis wagon	13	12
Platform wagon	26	50
	—	—
Total	56	59

The work in this case was done, not by a highly trained crew, but by ordinary laborers directed by one expert.

THE SCHOOL OF FIRE FOR FIELD ARTILLERY.

This school being now fairly started, and great interest being felt in its work throughout the service, the following notes on the general character of instruction given have been furnished by the Secretary for publication in the *Journal*.

In G. O. 72, W. D., 1911, the four courses of the School are outlined. These are:

Course A. For captains and lieutenants of field artillery, and such officers of infantry and cavalry as may be detailed.

Course B. For field officers of field artillery.

Course C. For non-commissioned officers of field artillery.

Course D. For militia field artillery officers.

These courses are more or less interdependent, and full benefit could not be derived from any one without the existence of the others. All are now in full operation except Course D, and a class for this course is about to be detailed.

These notes deal with Courses A and B. The program for the present class covers the period from February 15th to May 15th with practical work daily in actual or simulated fire and all the necessary incidents thereto.

All simulated fire problems and target practice are preceded by instruction in panoramic sketching and followed by field critiques. Later, detailed critiques are held of the target practice reports, when the student officers are called upon to analyze the results obtained and compare them with what might have been expected from the probability tables.

From April 15th to May 15th field officers will be detailed as battalion commanders, to exercise fire direction. Only one battery will be used, the other two being imaginary but considered in the tactical situation. A second field officer will be detailed to follow the practice in all technical and tactical details, for the subsequent critique.

A general outline of the work under the various specific heads follows.

Panoramic Sketching. Sketches of an assigned sector, seeking and identifying targets within sector and noting them in their proper positions on the sketch; all targets are referred by horizontal coordinates expressed in mils to some well defined reference point

in the sketch. The sketches being completed, officers will occasionally be required to orient maps of the ground concerned, locating their own positions; positions of other friendly troops mentioned in the problem; targets, with ranges and angles of site; selection of routes of advance; tentative positions to be occupied in case of advance, with due consideration of tactical situations, and special attention to the ground a retiring enemy must cross; same study with a view to retirement instead of advance.

Battery Drill. Manipulation of the battery tactically and technically. Orders to battery or battalion commanders from higher commanders set forth the tactical situation in detail, effort being made to give such information and orders as might reasonably be expected during the progress of an engagement. The manner in which these orders are carried out is discussed in the field critique which immediately follows each exercise.

The technical points noted are: reconnaissance and occupation of position, time consumed, merits of position chosen; use of scouts; kind and amount of ammunition used; placing of limbers and field and combat trains; methods used in transmitting data; identification of targets; method of ranging; handling of fire. Reconnaissance should include selection of probable routes in case a change of position becomes necessary. When field officers are present placing and handling of ammunition trains should be included.

The small amount of ammunition available prevents fire for effect. After adjustment, theoretical deductions are made from the ranging fire as to the amount of ammunition that should be required to produce a given effect.

In simulated fire, use is made of smoke bombs to represent bursts.

Practice is given in the use of all authorized instruments, with discussion as to the best methods of use, and instruction in their care and adjustment under all conditions.

Practical Ballistics. This subject embraces the use of probability tables; methods of obtaining firing data; study of trajectories; relations of range, angle of site, corrector; operation of fuzes; range tables. The Handbook for the Three-Inch Matériel and the Manual of Gunnery and Explosives are used as text books.

Boards of officers are appointed from time to time to investigate problems of ammunition supply, etc. Lectures are given by student officers during the latter part of the course, upon subjects assigned at the beginning.

Critiques. Discussion is conducted according to the following outline.

I. Did the officer conducting the fire take the correct view of the tactical situation?

Did he designate the target correctly? This designation should not involve too many descriptions or take too long. When the target is very difficult to see, the battery commander should himself lay the directing gun, or call up the gunners and show them the target through his own instrument.

II. Kind of ammunition and method of adjustment, considering (a) character of terrain; (b) point of target selected as adjusting point; (c) visibility of target; (d) change of target.

III. Were correct commands used for opening fire and for changing target? Were they given in correct order?

(a) General direction of target how indicated? (Right front, straight ahead, left front, etc.)

(b) Was the target correctly described?

(c) Was the best point of the target selected as adjusting point? (Considerations—visibility of target, direction of wind, position of directing gun with respect to most visible point of target.) Should time or percussion fire have been used?

(d) Means adopted to insure laying on correct point of target; location of directing gun in indirect fire; selection of auxiliary aiming point by platoon commanders.

(e) Method of laying for range,—sight or quadrant.

(f) Were results of previous fire on same day considered in selecting corrector setting? Was proper corrector setting determined in fire for adjustment?

(g) Was range well estimated? Were the following points considered in estimating:—form of ground; position with respect to former targets; maps when available?

(h) Was deflection allowance made for wind? Was it correct?

(i) How was the angle of site determined?

(k) Selection of observing station by battery commander. Were auxiliary observers used?

IV. Was range correctly determined; was bracketting necessary? Number of rounds expended, and time required in ranging. Were questionable shots considered in deciding whether correct range had been obtained? Was most effective range actually determined?

V. Was distribution of fire good?

VI. Was time fire for effect commenced at right range? Was correct range selected when changing from percussion ranging fire to time fire for effect?

VII. Were rules of Firing Regulations correctly applied for correcting height of burst? How long did it take? Method of fire selected? Rapidity of fire?

VIII. Were rules for observation of fire properly applied? (Shadow from smoke of burst; fragments striking around target; effect on target.)

IX. Was time for bracketting too long? (Consider visibility, location and motion of target.)

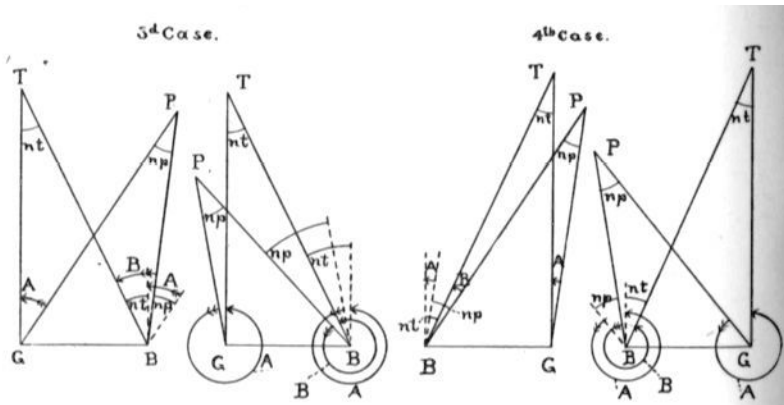
X. Was effect produced sufficient, considering time, ammunition expenditure, nature and location of target?

XI. Was problem correctly solved? Would other means have expedited solution? Were best methods selected to gain end with least delay and loss?

"GUNNERY AND EXPLOSIVES."

A correspondent has called attention to diagrams 3 and 4, Appendix D, of the authorized manual on Gunnery and Explosives. These diagrams, with the accompanying equations, while correct geometrically, are misleading, in that no account is taken of the direction of measurement of the angles, so that the algebraic signs in the equations do not correspond with the usual convention. The diagrams below bring out this feature, showing the sign of n to be negative when B is to the left of G. The equations are:—

- Case 3: $A = B + np - nt = B + n(p - t).$
 Case 4: $A = B - np + nt = B - n(p - t).$



The same correspondent points out a typographical error on page 30 of the same manual, where the second formula, in the middle of the page, should read

$$\frac{\sin T}{BG} = \frac{\sin b}{GT}$$

THE LIGHT ARTILLERY SABER.

Last November, at Fort Sill, an officer of the 5th Field Artillery, understanding that a new saber was being considered, proposed that "since for field artillery officers the saber is only a badge of office, the Field Artillery should, for historical reasons, get together in an effort to secure for this arm the old Light Artillery saber and the exclusive right to use it."

The officers then present at the post and the School of Fire being practically unanimous in support of this idea, letters were sent to all regimental adjutants requesting them to ascertain the views of their officers. The results of these inquiries show an overwhelming sentiment among the officers present with their regiments in favor of the change, the number dissenting being as follows:—

1st Regiment	6
2d Regiment (2d Battalion only)	0
3d Regiment	2
4th Regiment	4
5th Regiment	0
6th Regiment	1
<hr/>	
Total dissenting	13

WANTED TRANSLATORS.

The Journal is informed that the General Staff is finding some difficulty in getting German articles on technical field artillery subjects properly translated. There seem to be plenty of field artillery officers on the translators' lists for other languages, but most of the volunteers for German are from other arms, and are naturally unfamiliar with the technical language of these articles.

It is requested that officers of Field Artillery who read German, and who are willing to do translating, send their names to the Secretary, Army War College, Washington. Specially selected articles of this class will be sent them.

DIARIES OF EQUITATION WORK AT THE MOUNTED SERVICE SCHOOL

Furnished by direction of the War Department for publication in the Journals of the Cavalry and Field Artillery Associations.

The course of instruction is from October 1st to June 15th. The school has four classes of horses.

1. *Breaking class.*—Three or four year old colts; work begins about April, gentling, longing, saddling and bridling, carrying rider to front at walk and trot, simple turnings.

2. *Training class.*—Colts that have been through breaking class of previous year. Each student officer trains at least one as an officer's charger.

3. *School class.*—Horses that have been through the two preceding classes. On these the student is taught good seat and hands and the use of the aids.

4. *Jumping class.*—Aged horses with some training and jumping ability; used to pound the student into a good firm seat, to teach jumping both indoors and out of doors, for following the hounds, etc.

During the first month the work is chiefly to harden both men and horses. Men must be gotten into condition for six or eight hours hard physical work a day; horses have been in pasture all summer and are very soft.

OCTOBER.

Training Class. One hour per day.

2. Adjustment of cavesson; explanation of longing; colts longed both hands at walk, quietest ones at trot.
3. Continuation of 2; trot.
4. Continuation of 3; surcingles put on last five minutes.
5. Same as 4; surcingles put on last 15 minutes and drawn tighter.
6. Review. Surcingles put on early in lesson, and saddles, without girths or stirrups, laid on last 5 minutes.
9. Longing on both hands; saddles without stirrups girthed on, last 5 minutes.
10. Longing, saddles on with stirrups up; last few minutes, stirrups let down.
11. Same as 10; stirrups down after first few minutes. At end, riders mounted, assistant holding colt, first testing colt by bearing weight in stirrup. Colts then led in circle by assistant
12. Same as 11; but colts mounted earlier.
13. Snaffle bridles put on, colts mounted, then released by assistant; 15 minutes at walk, both hands.
14. Same as 13; but walk 20 minutes.
16. Only 30 minutes available; exercise on longe.
17. Colts longed, mounted without assistance, walked.
18. Same as 17, with short trot on each hand in column.
19. Same as 18, with trot at will; colts that pulled in column put on circle.
20. Longed without and with saddle; mounted; walk and trot in column and at will.
21. Same as 20, with short gallop on both hands; no attention to leads.
23. Same as 21; longing time decreased; some colts saddled at stable; all ridden from hall to stable.
24. Longing without and with saddle; mounted; walk and trot on straight lines and circle.
25. Same as 23.
26. Same as 23, with some galloping.

27. Same as 26; also alternating slow trot and trot out.
28. Same as 26, with a few minutes at half turns in reverse.
30. Longe Colts mounted and ridden at natural walk and trot. Explanation of seat and aids at trot.
31. Longe Walk and trot mounted; correction of seat, hands and legs of riders.

School Class. October 2-7, one hour per day; 9-31, two hours per day.

2. Longing in hall one hour, after explanation and demonstration.
3. Longing 20 minutes, then mounted work. Object lesson with green horse.
4. Same as 3, with less longing and more mounted work.
5. Mounted work in hall, snaffle bridles. Instruction in mounting and dismounting, holding double reins, rising to trot, adjusting stirrups, etc.
6. Walk and trot in hall, on both hands.
7. Extended trot, close and rising seats; spirals, etc.
9. One hour in hall, one outside, walk and trot; instruction in position of feet, legs, body, etc.
10. One hour in hall, one outside; application of aids, collecting horses, individual circles, figures of eight, etc.
11. Same as 10.
12. Same as 10.
13. One hour in hall, one outside. Suppling exercises leaning back, opening knees, vaulting, etc.
14. One hour in hall, one outside; extended trot, close and rising seat; suppling exercises.
16. Same as 14.
17. Same as 14.
18. Same as 14, but more collection required, and more exactness in seat and in handling reins. Short gallop.
19. Same as 18.
20. Same as 18. Outside work chiefly walk, through woods and up and down bluffs.
21. Same as 18.
23. One hour in hall, one outside at walk, trot and gallop. In hall first few minutes used exercising individually on track, walk and trot. Riders, in turn, at head of column, halt on inner track and keep horse standing quietly until column passed; rear rider passes to head; figures of eight, 20 feet diameter.
24. Same as 23.
25. Same as 23, adding gallop.
26. Walk, trot and gallop, individually and collectively; figures of eight, suppling exercises, etc.
27. Work in hall as on 26, but more extended; outside over rough country.
28. Indoor work as on 27; outside on road.
30. Figures of eight at slow trot, leaving column individually, suppling exercises, serpentine (close and rising seat); individual circles, work at will in suppling and collecting horses.
31. Attended garrison review; took brush and rail jumps on return.

Jumping Class. Two hours per day.

2. Saddling and bridling; road work at walk, trot, slow gallop.
3. On road 8 miles, walk, slow trot and trot out, and twice half a mile slow gallop.
4. On road 7 miles, walk and trot; remaining time trot and gallop at will on Ogden Flats.
5. Same as 4, adding 15 minutes slow trot on circle in column.
6. Across country, walk and slow trot, 8 miles; slow gallop $\frac{3}{4}$ mile; work at will 10 minutes.
7. On flats, walk and trot 7 miles, slow gallop $1\frac{1}{4}$ miles; visited paddocks.

9. On road and cross country, walk, trot and gallop; small brush jump.
10. Short drag hunt; inspected kennels.
11. In hall, walk and slow trot, circles, serpentines, etc.; loosening and dropping reins at trot.
12. Forded river belly deep; walk, long trot and 1½ miles gallop, through woods and on road.
13. With fox hounds after coyotes; mostly walk, short gallop; jumped five or six post and rail jumps through pasture, two bars let down.
14. Walk on road; trot and gallop on circle; two brush jumps 3 feet high.
16. In hall; changing gaits; riding without reins, with and without stirrups; suppling exercises for riders.
17. Across river; long trot, gallop 1 mile.
18. Same as 16; in addition, small jump individually.
19. Road 13 miles, walk, trot and short gallop.
20. Same as 18, adding individual circles about stakes.
21. On wood road; 1 mile trot; 6 log jumps individually at trot; 3 log jumps 25 yards apart, at slow gallop.
23. In hall one hour; trot and gallop, with and without reins and stirrups; suppling exercises; 1½ foot jumps, walking to wings and trotting over; same jumps without reins, horses led to wings and then released. Outside one hour; two ¾ mile gallops in woods.
24. Indoors same as 23; adding individual circles about stakes. Outside, at a walk over rough ground; in woods, attempting a mile in 6 minutes at trot, individually.
25. In hall, same as 23; also several times over 1½ and 2½ foot wicker jumps. Outside, as on 24.
26. Same as 25.
27. After jack rabbits with wolf and greyhounds.
28. Quiet work up and down cañons, galloping between.
30. In hall; jumping as on 23d, suppling exercises.
31. Drag hunt up Magazine Cañon to Morris Hill, taking three or four brush jumps; two instructors at head, one at rear.

NOVEMBER

Training Class. Nov. 1-11, one hour per day; 13-30, ¾ hours per day.

1. Longed a few minutes. Mounted, walk and natural trot; correction of seat, hands and legs. Individually, front to rear at walk, rear to front at trot.
2. Same as 1; also on right or left into line at walk with large intervals.
3. Same as 2; crossing hall at trot; short trot out on both hands.
4. Same as 3.
6. Longe 10 minutes. Trot out and natural trot on both hands, close and rising. Passing from walk to trot and back, explanation of aids.
7. Same as 6.
8. Same as 6. Dismounted flexions, lateral and vertical.
9. Same as 8. Individual work at trot, smaller circle. Dismounted, displacing haunches with whip.
10. Same as 9. Canter on left hand by extending trot.
11. Exhibition of work to date, for Secretary of War and Chief of Staff.
13. Longing omitted. Trot out, both hands, at will. Dismounted flexions. Slow trot with moderate collection, straight lines and circles. Dismounted, displacing haunches with whip used on side next trainer.
14. Same as 13; also displacing haunches with whip used on side away from trainer.
15. Same as 14; also moving haunches one step to right or left, mounted, at halt; flexions, mounted, at walk.
16. Same as 15; also slow trot, holding proper distance for a few minutes.
17. Same as 16.
18. Same as 16.
20. Trot out at will on both hands, with good intervals, crossing hall at will. Flexions, mounted, at walk. Increase and decrease of gaits. Half turn in reverse.

21. Same as 20. Slow trot on circle holding true distance. Canter.
22. Same as 21; particular attention to holding distances and "half halt" in decreasing gaits.
23. Same as 22.
24. Same as 22.
25. Same as 22.
27. Trot out on one hand; rest, and canter on other hand. Sharp changes in direction at slow trot. Half turn in reverse at slow trot. Changes of gait, with halt from slow trot and trot out from halt.
28. Same as 27. Individual circles at will, slow trot.
29. Straight away work out at trot and canter on both hands.

School Class. Nov. 1-11, 2 hours per day; 13-30, ¾ hours per day.

1. In hall one hour; short workout at will, at trot; collectively at trot and gallop on track, both hands; circles, by flank, and figures of eight; suppling exercises at walk and trot. Outside one hour, walk, trot and gallop over varied ground.
2. Same as 1.
3. All work inside, same as 1; some snow and freezing weather.
4. In hall; by flank, individual circles, serpentines and figures of eight at trot; on both hands at walk, trot and gallop; suppling exercises at trot.
6. One hour outside at walk, trot and gallop, including up and down slopes, through woods and broken ravines.
7. Inside; walk, trot and gallop on track; on circles and by flank at trot; leaving column and rejoining; suppling exercises. Outside at walk, trot and gallop.
8. Same as 7.
9. Same as 7; also riding into corners of hall by pressure on inside rein and leg.
10. Same as 7.
11. Exhibition for Secretary of War and Chief of Staff.
13. Short individual work-out; on track at walk, trot and canter; circles, by flank, trooper from front to rear, both toward center of hall and between column and wall; suppling exercises.
14. Outside; in pairs for exercise, walk and trot.
15. In hall. Trot out, slow trot with considerable collection, halt from slow trot, canter.
16. In hall. Balanced trot, half halt, change of direction and holding haunches, canter.
17. Same as 16.
18. To Ogden Flats for artillery review.
20. In hall. Slow trot at regular distances, small circles, half turns in reverse.
21. Same as 20.
22. In hall. Half halt and retarding aids to assist in training colts; half turn in reverse; trot and canter with stirrups; mounted flexions. Canter, halt, trot out.
23. Same as 22.
24. Same as 22.
25. Same as 22.
27. Same as 22. Also trot out and gallop with stirrups and without reins; decreasing gait without changing it
28. In hall. Work out; flexions mounted; small circles; canter, halt, trot out.
29. Run with wolf hounds.

Jumping Class. Nov. 1-11. 2 hours per day; 13-30, ¾ hours per day.

1. In hall. Work-out at will; usual jumping, with reins; also once over without wings.

2. On road, walk and slow trot. In hall, individual gallop by extending trot, and from slow trot by lateral aids.
3. In woods, trotting in column closed up, and extending distances; several small jumps. In hall, over two wicker jumps 20 feet apart without reins or stirrups; also over two jumps 3 feet apart.
4. In hall, suppling exercises, mostly without stirrups; three small jumps 20 feet apart without stirrups or reins. Outside, horses weighed; on road in pairs for quiet work.
6. Coursing meet west of Junction City. Going, rode at walk and trot; returning, 1¼ miles extended gallop.
7. Open air hall, trot and gallop individually, with and without stirrups; gallop from slow trot by lateral aids, special attention to keeping neck straight with inside rein, and use of inside leg to drive. Outside, one mile over Republican jumps at 18-mile gallop. Inspected 15 young horses just from Reno Remount Depot.
8. One hour trot and gallop in open air hall; outside, walk and gallop, over two Republican jumps; returning, led over three small jumps.
10. Without stirrups, across river, over flats and through woods, walk, slow trot, and about 2 miles gallop; over a few jumps, small banks and ditches.
11. Exhibition in hall.
13. Workout in hall; small jumps, with and without reins and stirrups.
14. In hall. Suppling exercises; trot and gallop without stirrups; two wicker jumps, 1½ and 2½ feet high, 4 feet apart.
15. In hall. Short work-out, trot and gallop at will; twice over 3 feet 6 inches post and rail; suppling exercises, without stirrups.
16. In hall. Gallop in pairs; suppling exercises; without stirrups or reins twice over three wicker jumps 12 feet apart.
17. Same as 16, except third jump 100 feet beyond second, reins taken after second.
18. On road in pairs, walk and trot; inspected 18 horses just from Kentucky.
20. Light work in hall; singly over small jumps in woods.
21. In hall. Suppling exercises; twice over 3 feet 6 inches post and rail.
22. In hall. Suppling exercises with and without stirrups; galloping in pairs, individually and in column; jumping with reins and stirrups, 1½ feet wicker in center of hall, halt at wall, then in and out of wickers 3 feet high and 20 feet apart on track. First jump without wings, others with.
23. Same as 22.
24. Suppling exercises in hall.
25. Work-out in hall; over two 3 foot wickers 75 feet apart. Visit to pastures, inspecting all horses.
27. In hall. Suppling exercises, mostly without reins or stirrups; over three wicker jumps 20 feet apart, without reins or stirrups.
28. In hall. Work-out individually; twice over two 3-foot wickers 100 feet apart, no wings.
29. In hall at trot and gallop; outside through woods, log and rail jumps.

DECEMBER.

Training Class, ¾ hours per day.

1. In hall. Work-out at trot and canter; half turn in reverse, individual small circles, change of gaits, and halt from slow trot. Special attention to holding distances.
2. Same as 1.
3. Same as 1.
5. Review at will, particularly on small circles with haunches held to track forehand; half turn in reverse in column, slow trot.

6. Review at will. Also explanation and exhibition of "haunches right (left)"; each colt required to do a few steps.
7. Gallop at will on both hands; haunches right as on 6th, but more steps required.
8. Review at will. Haunches right a few steps at slow trot.
9. Road work, walk and trot.
11. Same as 9.
12. In hall. Drill in column at slow trot, movements by flank and obliques. First rider at canter twice round hall, joining rear. Balanced trot with collection, small circle, half halt, changes of gait, haunches right and left.
13. In hall. Work-out at canter. Review at will at slow trot. Oblique on two tracks.
14. In hall. Work-out at trot, same as 13, but more work on two tracks.
15. In hall. Work-out at trot; taking canter on both hands on track, with true leads. By fives at trot down hall, and by flank at end, on same hand, preserving dress, interval and cadence.
16. Same as 15. haunches right and left at slow trot; oblique on two tracks at walk; canter in column on track and on circles.
18. In hall. Small circles individually at slow trot, making use of corners; haunches right and left, obliques, canter, as on 16; first rider twice around hall to rear of column, at canter.
19. In hall. Work-out at trot. Small circles individually in corners on left hand, followed by canter in column on left hand; same on right hand. Review at will, slow trot.
20. In hall. Drill in column at slow trot; canter on both hands: circles to right or left about from column at walk; haunches right on left hand, and left on right hand, at walk individually.
21. In hall, same as 20.
22. In hall. Work-out at trot and canter. By flank by fours down center of hall at trot; work with haunches as on 20.
23. In hall. Work-out on both hands at trot. Drill in column, by flank, and half turns in reverse at slow trot. Circles right and left about at walk.

School Class, ¾ hours per day.

1. In hall. Five minutes at will, walk and trot, both hands. Same on track, frequent short rests; increase and decrease of gaits, legs closed, heels down, upper body back; circles, by flank; dismounting with and without stirrups, keeping horses in place. Horses nervous.
2. Same as 1.
4. In hall. More collection, deeper seat, longer stirrups, legs farther back, heels more depressed. On track in two sections, walk, trot and canter; circles, by flank, etc.; walk from canter.
5. First platoon same as 4. Second platoon outside; in woods on track, walk, trot and gallop; three log jumps at slow pace; each rider halted 50 yards beyond jump, faced about and kept horse standing until all over.
6. Same as 5.
7. Second platoon in hall. First platoon on hunt with fox hounds.
8. In hall. Five minutes individual work on track. On track in two sections, abouts, circles, by flank, etc., at trot. Walk, trot and canter on track, both hands. Dismounting and mounting with stirrups, both sides, horse held. Suppling exercises.
9. Same as 8.
11. On track in woods, walk, trot and gallop. Four 3 foot jumps; first taken as on 5th, others in column at 50 yards, jump at slow gallop, trot between.
12. In hall. Five minutes individual work-out. Work on track all gaits, both hands. Haunches right or left on track at walk, toward interior of hall.

13. Same as 12.
14. Same as 12.
15. Same as 12. By threes from column, down hall, back to column; odd numbers to right and even to left, forming two columns and reforming one. Haunches right or left to inside at slow trot; to outside at walk.
16. Same as 15.
18. Same as 15.
19. Same as 18; haunches right and left discontinued, also work by threes. Individual halt from collected walk, and moving out at trot. Whips carried.
20. Same as 19.
21. Same as 19.
22. Same as 19.
23. In hall one hour. Individual work-out five minutes. On track in two platoons, all gaits. Large spirals, by flank, about, slow trot from halt, halt from slow trot. Oblique on two tracks. Individual about at canter. At halt, without stirrups, dismount to left, vault and mount.

Jumping Class, ¾ hours per day.

1. In hall. Work-out at will; individually taking gallop leads on diagonals of hall; small wicker jump in center of hall at walk, halt at wall, turn to left, take 3 feet wicker on track at gallop; no wings.
2. In hall, suppling exercises with and without stirrups and reins; gallop leads on diagonals. Outside in open column through woods at trot and gallop, on roads at walk.
4. Same as 2; also three wicker jumps, 1½ feet to three feet, 20 feet apart, without stirrups or reins.
5. Through woods at trot and extended gallop; over double in and out of logs at trot.
6. Up and down steep banks and over ditches at walk and quiet trot.
7. Same as 1.
8. In hall. Work-out at will; long gallop in twos, closed and extended distances.
9. No work by class.
11. Through woods at all gaits, low jumps.
12. Through woods and hill pastures well strung out in column at gallop; five 3 foot jumps.
13. In hall. Work-out at will, trot and gallop; gallop individually and in pairs.
14. In hall; same as 2 and 4.
15. Over Republican jumps strung out in column at gallop; five jumps 3 to 3½ feet.
16. Outside. Three parties under leaders concentrate at given point in one hour; distances 5½ to 6½ miles.
18. Same as 4.
19. In hall. Trot and gallop, individually and in column; small wicker jump in center at walk, halt at wall, turn to right, 3 feet wicker on track at gallop, halt at end, turn about, two 3 feet wickers on track 100 feet apart at gallop; no wings.
20. Same as 19.
21. In hall. Trot and gallop, individually and in column; 3 feet wicker without wings, approach at slow trot, jump at gallop.
22. Same as 21; also jump at slow trot.
23. Suppling exercises; single wicker at walk, in-and-out at trot; no wings.

CURRENT LITERATURE.

All the books and periodicals referred to below are on file in the War College Library. Officers desiring to consult them should address The Secretary, War College Division, General Staff.

CONTENTS OF PERIODICALS.

JOURNAL OF THE ROYAL ARTILLERY. (Royal Artillery Institution, Woolwich, England.)

December, 1911.

Universal Projectiles.—Col. H. A. Bethell, late R. F. A.

Historical sketch of the development of the combination shell and shrapnel, with drawings showing different types and plates illustrating fragmentation. After reviewing the advantages and weaknesses of this type of projectile, the writer concludes that it can advantageously replace shell for field guns, and that further experiment must determine whether it should be substituted for shrapnel also.

A Note on "Artillery Training."—"Field Gunner."

Further comment on the paper under this title in the number for August, 1911, which has already drawn out some discussion in the November number (see *Field Artillery Journal*, September and December, 1911). This writer joins issue especially on the question of open and masked positions, arguing against the abuse of the latter.

Defense of a Fortress Against Aerial Attack.—Lieut. J. W. Marsden. R. G. A.

In view of the present early stage of development of aerial craft, this paper does not attempt to go into detail, or to give definite answers to the questions involved. It is rather an outline, suggesting the possibilities, and as such should be very useful in studying the subject.

The Spirit of the New French Strategy.—Col. F. N. Maude, R. A.

Lecture delivered at the Royal Artillery Institution, October 26, 1911. Discusses deep *versus* broad strategic formations. Finds the essence of both Napoleonic and modern French strategy to be the use of deep formations, the head engaging the enemy and making the "fixed point" for maneuver. The point is illustrated by a well-drawn comparison of the Ulm and Metz campaigns.

The Unsteadiness of Projectiles.—F. Wolley-Dod.

This paper is inspired by a book on "The Bullet's Flight," by Dr. F. W. Mann, recently published by Mann & Co., of New York. It considers the dynamical laws governing the motion of an unsteady projectile; describes and analyses some of Dr. Mann's experiments; and suggests further experiments to determine how to reduce unsteadiness.

French Field Artillery Training.

Extracts from the new French Regulations, with comments: translated from "Rivista di Artiglieria e Genio."

The Ehrhardt Combined Shell.

Extracts translated from "Mitteilungen über Gegenstände des Artillerie- und Geneiewesens." October. 1911.

January, 1912.

Control of Divisional Artillery in Battle.—Maj. W. H. F. Weber, R. F. A.

A discussion of the extent of control to be exercised by the artillery brigadier over the fractions of his command, with suggestions as to the means of exercising this control.

Aviation.—Lieut. T. H. Sebag-Montefiore, R. F. A.

A simple description of the processes of flight, intended for the beginner.

Mystification of the Adversary in War.—Lieut. Col. C. Ross.

A lecture delivered at the Royal Artillery Institution, November 1911; a selection of instructive instances of "mystification" on a large scale, from modern military history.

Musketry for the R. G. A.—Capt. C. J. D. Freeth, R. G. A.

Suggestions as to the value of musketry training for coast artillery troops.

Memorial de Artilleria: Summary of Contents for April, May and June, 1911.

Caliber of Heavy Guns for Coast Defense.—Translation from "Rivista de Artigleria e Genio."

Employment of Air-Craft in Foreign Maneuvers of 1911.—Abridged translation from "Mitteilungen über Gegenstände des Artillerie- und Geniewesens," November, 1911.

February, 1912.

The Tactical Employment of Field Defenses.—Maj. E. D. Swinton, R. E.

A lecture delivered at the Royal Artillery Institution, February 16, 1911, by an officer well known to American military readers as the author of the "Defense of Duffer's Drift." He lays down as his fundamental proposition that trenches should be used to wear down the offense, and keep busy a number of the enemy superior to the force holding them; that since special pains have been taken to prepare the holding troops for trouble, they should be constantly "looking for trouble." He traces the natural course of an attack on a prepared position, and deduces the proper system of preparation,—a series of strong places for infantry, of varying size and shape and at varying intervals, each capable of allround defense if necessary, with artillery posted so as to flank dead space.

Topographical Survey in Tropical Africa.—Capt. R. H. Rowe, R. G. A.

A short account of the methods and organization of the Southern Nigeria Survey, by the Deputy Director of the Topographical Branch.

Military Operations on the Mekran Coast, 1910.—Lieut. H. E. Kenyon, R. A.

The smuggling of arms into Afghanistan is one of the great dangers of the Indian frontier. It appears that most of these arms are landed on the Mekran coast, which is on the Arabian Sea at the extreme southeast corner of Persia, and thence carried overland. The Navy patrol being unable entirely to prevent this traffic, the Indian Government, from January to April, 1910, maintained a sort of amphibious force in these waters, consisting of some 600 men, with two mountain guns. This force cruised along the coast in a transport, landing whenever contraband arms were

located by agents. This article contains interesting descriptions of this unique service, with remarks on methods of landing and embarking the animals.

Staff's in the Divisional Artillery.—Capt. G. E. Bolster, R. A.

The writer holds that the English artillery is still organized and trained with too much reference to the individual battery and not enough to the higher units. He here proposes a reorganization of staffs, reducing the number of men required, and assigning a much larger proportion of them to the higher artillery commanders.

Notes on the Battle of Liao-Yang.—Lieut. R. G. Cherry, R. F. A.

A review of the battle, pointing out five distinct "lost opportunities" of the Russians.

"L'Artillerie aux Manœuvres de Picardie."—A summary of Gen. Percin's conclusions in this important book, a review of which appears in this number of the Field Artillery Journal.

Methods of Fire of the Infantry Battery.—Translation of the article by Major Buat, in the "Revue des Sciences Militaires," a translation of which appeared in the Field Artillery Journal for September, 1911, under the title "Fire against Infantry."

REVUE D'ARTILLERIE. (Librairie Berger-Levrault, Rue des Beaux-Arts, 5, Paris).

October, 1911.

The Adoption of an Automatic Rifle.—Lieut. Col. Leleu.

Historical review of the progress of military rifles since 1886, when the present French rifle was adopted, with suggestions as to the requirements to be fulfilled by the automatic rifle ultimately to be adopted.

The "B" Element of the Goulier Telemeter.—Capt. Dufournier.

This range finder is generally regarded by the French artillery as valueless, and, while it forms a part of the battery equipment, little use is made of it. The "B" element is on the sextant principle; the present writer describes a number of useful applications of it in reconnaissance and in preparation of fire.

November, 1911.

The Fire of Batteries with High Defilade.—Gen. Herment.

This article is inspired by the one on the same subject by Major Sautereau du Part, in the September number (see Field Artillery Journal for December). Recognizing the desirability of using positions far in rear of the mask, but considering the methods proposed by Major du Part as too cumbersome, the writer describes actual firings from such positions by the 1st and 19th Brigades of artillery, giving in detail the simple graphic methods employed.

The German Field Artillery Firing Regulations.—First instalment of a translation of the Regulations of March, 1911.

Fire with Graded Elevations.—Capt. Martin-Decaen.

Proposition for the habitual use in adjustment of two or more ranges in each salvo. A movable zero mark on the elevation scale is suggested.

permitting elevations to be varied by any desired amount from gun to gun, on the principle of "increase or diminish" in deflection, but without any calculation at the guns.

December, 1911.

Aeroplane Ballistics.—P. Charbonnier.

Theoretical discussion of the trajectory of a projectile dropped from an aeroplane, with range tables and calculations as to probable accuracy.

Sight for Directing Projectiles from Aeroplanes. M. Brocq.

Description of a sighting instrument patented in France in August, 1911, having one scale graduated for height and another for speed of the aeroplane. Seems much to resemble the instrument described in the *Scientific American* for October 28, 1911 (see *Field Artillery Journal* for December).

The German Field Artillery Firing Regulations.—Continuation of translation commenced in November number.

January, 1912.

Aerostation and Aviation.—M. Clémentel.

Extract from the report of the Budget Committee on the military appropriation bill for 1912, discussing the present status of military aeronautics in France.

Study in Artillery Fire.—Capt. E. Pagezy.

A somewhat elaborate paper on the problem of clearing the mask.

The Guilléry Aphegraph.—M. Guilléry.

Description of an instrument for constructing tangents to curves, where, as in certain graphic studies of velocities and accelerations, rigorous accuracy is necessary.

ARTILLERISTISCHE MONATSCHEFTE. (A. Bath, Mohrenstrasse 19, Berlin.)

December, 1911.

Notes on the 1911 Maneuvers.

A review similar to the one on the year's firing practice in the November number (see *Field Artillery Journal* for December); it is pervaded by the same spirit of enthusiasm for the new methods as opposed to the old. The writer notes that habitually battery commanders did not lead their batteries into position personally, but marked out the position and sent orders to the senior lieutenant; this practice he approves for deliberate occupation of position. It appears that double section is not habitually formed before unlimbering, but the caissons kept behind all the guns, after the old German fashion, and unlimbered later; hence frequent interference between caisson and piece limbers. Some of the old rules for moving off limbers are found no longer applicable, and it is proposed to handle the matter much as we do. The use of flags or heliographs to indicate the target in maneuvers is criticised as betraying the position too much; the plan adopted in some of our own maneuvers is favored instead,—different kinds of fire for infantry and artillery targets. Open positions were rarely taken: even when they were, indirect fire was used. A very natural tendency of artillery brigadiers is noted, to leave division headquarters and their tactical duties, join their batteries, and take a hand in fire direction. Several interesting examples of communication between infantry and artillery are given, and two situations noted are reported in detail.

Preparation of Fire and Masked Positions.—Gen. Rohne.

Continuation of article in the November number (see *Field Artillery Journal* for December); deals with the problem of clearing the mask, and discusses at length various solutions.

Exercises in Fortress Warfare.

Calls attention to the importance, and to some of the peculiarities of fortress warfare, and makes suggestions as to plan and conduct of exercises for training mixed commands in such work.

The Russian School of Fire.

Review of the report of the Field Artillery School of Fire for 1910. The theoretical course was three months, the practical firing course four months; 22 field officers and 66 captains and lieutenants took part. Three field artillery brigades, a mortar battalion and a horse battery were attached to the school for the firing season. A short outline of the course is given, with some of the recommendations for improvements. It is interesting to note that the school urges reduction of the number of guns in a battery from eight to six or four; and also that it is desired to close the firing season with maneuvers and field firing in connection with an infantry division.

January, 1912.

Frederick the Great and His Artillery.

The two hundredth anniversary of Frederick's birth having occurred in January of this year, the German periodicals have been devoting some extra attention to his history. This paper is a very interesting review of his views and acts with respect to his artillery, giving a number of small details not usually found in such papers.

Notes on the 1911 Maneuvers.

A continuation of the paper in the December number (see *supra*). First comes a brief discussion of some of the technical matters involved in rear guard action.—reconnaissance of position, march order, handling of regimental ammunition columns, etc. Next is a chapter on aerial reconnaissance. The writer notes the extraordinary progress in this as shown in the maneuvers, and makes suggestions as to fire upon aircraft; of these the most novel is the proposition to introduce, for the special balloon guns, a second projectile intended for aeroplanes. This projectile is to have a heavy charge of high explosive, to make air waves, and the envelope is to be so thin that the fragments can not be dangerous to troops on the ground. Reference is also made to experiments in concealing the guns from aerial observation. The durability and certainty of function of all the material is highly praised; the only strongly expressed wish under this head is for a "Comet" mast (described in number for May, 1911; see *Field Artillery Journal* for September) instead of the present observation ladder. In smaller matters of equipment, the writer favors the carbine for all the personnel, better harness saddles, and the new service uniform. He has a good word to say for the bivouac, as opposed to crowded quarters in buildings, which is unusual in a Continental paper; and vigorously opposes the tendency to call upon the artillery for officers and men as aides, orderlies, etc. In conclusion he returns to his demands (see *supra*) for panoramic sights and indirect laying, giving this more space than all his other suggestions combined.

The French Heavy Field Artillery.—"Marsyas."

A comparative study of the French and German heavy field artillery armament and organization. After commenting at some length on the French lack of light field howitzers, which are such a specialty in Germany, a description is given of the Rimailho 15.5 cm. howitzer, the regulation arm of the French heavy batteries. The fundamental difference is

pointed out, that the German heavy guns are distinctly mobile, and form an integral part of the Army Corps; the French approximate to the character of guns of position, and the batteries, although assigned to Field Artillery regiments in peace, in war are placed under the direct control of the army commander. The number of existing Remailho batteries is given as 21, of two guns each; the writer discusses at some length the question, whether in war they are intended to expand into 21 four-gun, or 42 two-gun batteries.

Fertical Fire with the Infantry Rifle.—Lieut. Eckardt.

Theoretical calculations of vertical range, time of flight, etc., with different bullets and charges.

The Krupp 28-cm Siege Howitzer.—Gen. Rohne.

An excellent description, with photographs, of the new Krupp howitzer. This is similar ballistically to the Schneider howitzer described in this number of the *Field Artillery Journal*, but differs from it absolutely in construction. It is fired from a wheeled carriage, whose heavy wheels are provided with flat hinged segments, so that it always travels on a flat surface. The gun itself travels on a separate carriage with similar wheels. The weight being on two carriages only, both are very heavy—20,500 and 22,200 pounds, ready for the road; hence motor traction is used instead of horses.

MISCELLANEOUS ARTICLES.

MATÉRIEL.

Practice Projectiles.

Krupp is making a new type of projectile, intended for use in combined field firing of infantry and artillery, and similar exercises. It is a shell with heavy walls, a very light high explosive charge, a charge of smoke-producing compound and a percussion fuze. The walls are slotted, and the slots closed by a light tin envelope. When the projectile strikes, the explosive charge ignites the smoke compound and drives it out through the slots in the form of dust, the tin envelope being ruptured. This gives the report and smoke of a bursting shell, without danger from flying fragments; for the small charge will not rupture the strong case.

Mitteilungen über Gegenstände des Artillerie- und Geniewesens, January 1912.

AERONAUTICS.

Observation of Fire from Aeroplanes.

An article on Swiss military aviation reproduces from a French paper the details of experiments made at Verdun with siege artillers. A number of heavy guns were to fire upon targets at 6,000 or 7,000 meters, entirely concealed. Four aeroplanes were used; observers in them first located the target on the map, and took photographs, afterwards observing the fire very successfully. The general plan developed was for the aeroplane to leave the ground in rear of the batteries and fly directly toward the target; as soon as it has passed over the guns, two salvos are fired in rapid succession, with say 400 meters difference in range. The observer is provided with weighted cards marked with eight dots, representing the eight points of burst, and an arrow indicating direction of fire; noting the position of the target with respect to the bursts, he marks a cross in the proper place on a card, and returning, drops it near the battery. The process is repeated until adjustment is obtained.

Revue Militaire Suisse, January, 1912.

Aeroplanes in Tripoli.

A review of what has been accomplished by the Italian aeroplanes in the present war. The number of machines in use is given as 17, 8 operated by officers and 9 by civilian volunteers; they are divided into four groups, at Tripoli, Benghazi, Tobruk and Derna. They appear to have done good service in reconnaissance, and also, in the attacks on the oases of Ain Zara and Tripoli, to have observed artillery fire successfully, using maps marked in squares. On November 1, at Ain Zara, an experiment was made in dropping bombs. The bombs used were the size of an orange, charged with pierie acid; four were dropped into a hostile camp with very good accuracy. The operator was unable to note the effect, but with such a bomb it could hardly have been considerable. Nothing has been heard of any subsequent attempts. No aeroplanes have been opposed to the Italian machines; efforts at defense have been solely by fire and have been ineffective.

Militär Wochenblatt, January 13, 1912.

TACTICS.

Communication between Skirmish Line and Artillery.

Discusses the duties of both infantry and artillery in maintaining communication. Suggests that, since the possible number of artillery officers' patrols is very limited, and connection between them and the batteries hard to maintain, they be habitually limited to tactical communication, assuring harmonious action of the two arms, and that the special case of notifying the artillery when the fire becomes dangerous to friends be considered as the affair of the infantry, and notice given, as in Manchuria, by display of flags.

Militär Wochenblatt, January 13, 1912.

BOOKS.

L'Artillerie aux Manœuvres de Picardie en 1910. By General Alexandre Percin. Paris, Berger Levrault & Cie, 1911.

This book, written by General Percin, of the French Army, known to American officers as the originator of the "P-T" system, marks one of the steps taken by the author to settle the vexed questions of field artillery tactics by experiment during maneuvers. In September, 1908, the 23 batteries then assigned to an army corps were gotten together for the first time at the fall maneuvers, each battery being represented by one gun and one caisson, and the valuable information concerning organization of higher artillery commands and the linking together of infantry and artillery that resulted from these experiments were published in his pamphlet, *Le Manœvre de Lorlange*. Since that time the French have raised their artillery component of a corps to 30 batteries in time of peace, and this increase at once raised the questions whether suitable emplacements for 30 batteries could be found along the normal front of a corps and whether their simultaneous deployment would not seriously interfere with the advance and deployment of the infantry. To settle these questions, the 2d and 3d corps, each equipped with its full complement of artillery, were pitted against each other in September, 1910, in the province of Picardy, and General Percin was selected as chief umpire.

The question of the possibility of finding suitable emplacements for the 30 batteries was not answered during the maneuvers, owing to the fact that the extent of front occupied by a corps varied from 10 to 20 kilometers, and on only one day was it restricted to the normal length of from 5 to 6 kilometers. On this occasion, a brigade of infantry, in deploying for the attack of a village, had to pass between the guns of a

line of 18 batteries, thereby stopping the fire of the artillery. "Hence," says the author, "on the only day when the fronts were maintained within reasonable limits, the simultaneous deployment of 30 batteries interfered with the movements of the infantry. I do not claim that it will always be so. I believe that, if search had been made, other emplacements could have been found for the artillery and other routes for the infantry; but it must be admitted that it would be better if my statements could be supported by some proof."

Another question, which the author hoped would be definitely answered, was whether it is desirable to deploy at once the greatest possible number of batteries without waiting for their missions to be determined, or whether, on the other hand, it is better to keep a number of batteries in reserve for emergencies, in view of the difficulty of withdrawing a battery once engaged. Attention is called to the contradiction on this point between the principles laid down in the body of the latest French Drill Regulations and the views expressed in the "Rapport Justificatif," which serves as the introduction to that work. Although two excellent opportunities were presented for settling this question, no advantage was taken of them, due to the failure of the higher commanders to appreciate the situation.

The best method of insuring close coöperation between the infantry and artillery, according to General Percin, is found in the "single order" issued by the higher commander. "The order issued by the commander of the force is the basis of this connection. The best means of forgetting nothing, as well as the simplest and quickest means, is to draw up a single order for the infantry and artillery. This will give them each information as to their common mission and then the two arms can easily get together." The author complains that, of all the attack orders collected during the maneuvers, there is not one that can be quoted as a model; some are silent as to the objective to be attacked, others give false or contradictory data, while some indicate friendly troops as the objective of the artillery. Then follows a long list of examples of this failure to establish proper connection between infantry and artillery.

Another fault on the part of higher commanders which the author declares to have characterized the maneuvers, is their tendency to relieve themselves of all responsibility for the proper use of their artillery. Corps commanders turn over to their divisions all or part of the corps artillery, before the necessity therefor develops; division commanders distribute the guns *a priori* among their brigades; brigade commanders turn them over to the colonels, and the latter at times distribute the batteries among the infantry battalions.

As to the question whether artillery should be instructed always to seek priority in the occupation of position, the experiences of the maneuvers show that position should be selected with a view to the mission to be accomplished. "The Regulations should state the technical advantages resulting from priority of occupation, when one is lucky enough to secure such priority; but they ought not to recommend that it should be actually sought, because artillerymen would be led thereby to deploy their battalions before the mission was definitely known, independently of the needs of the infantry."

Space forbids reference to many other points upon which the maneuvers furnished valuable information. There is one passage, however that has a familiar sound, and that is given here for the benefit of artillery officers who have taken part in our maneuver camps. "I will add that, at the critiques. I have never seen even a remote approach to the proper consideration of the artillery's part in the maneuvers * * * * The director hears the recital of the terrible effects that the fire of the batteries would have produced. He pays homage to their mobility and to the effective coöperation which they would have

given to the infantry. He takes good care not to ask for the orders issued by the artillery commander in the execution of those received by him. He prefers to have everything in the shadows, and ends his critique by a distribution of bouquets."

A significant indication that the French are getting ready to abandon General Langlois' doctrine of superiority of fire is found in General Percin's statement that artillery in battle should seek for tactical and not technical results. "Above all things, the artillery should take position with a view to supporting the infantry. The first condition to be fulfilled is that the connection shall be maintained. Better to kill ten men at the proper time and in the proper place than to kill 50 whose loss will have no effect upon the progress of the attack." He therefore concludes that the best position should be allotted to the infantry batteries, and that positions for flank or oblique fire should not be sought for at the expense of the proper linking together of the infantry and artillery.

J. E. McM.

Etude sur le Tir d'Efficacité. Captain François Adolphe Tréguier. Paris, Henri Charles-Lavauzelle, 1911.

Like all of Major Tréguier's work on field artillery subjects, this little book on Fire for Effect is well worth careful study by our officers, whose attention heretofore has been so occupied with the study of Fire for Adjustment that little time has been available for study of Fire for Effect.

In Chapter I, he shows that for the 100 and 200 meter brackets, volleys at successive ranges differing by 50 meters, give a greater mean probable effect than the same amount of ammunition fired at ranges differing by 100 meters. But for the 400 meter bracket, on account of both time and ammunition factors, he favors 100 meter echelons. In this connection he also discusses and justifies the change in the method of executing *progressive fire*. In the French F. A. D. R. 1903, a 200 meter bracket was determined and *progressive fire* was then executed using 100 meter echelons beginning with a range 100 meters less than the short limit of the bracket. The 1910 Regulations prescribe that a 400 meter bracket shall be determined, and *progressive fire* is then opened at the short range of the bracket using 100 meter echelons as before.

In Chapter II, the author takes up time shrapnel fire against artillery behind a crest. From a simple and interesting mathematical study he draws the following conclusions:

WHEN THE FLASHES ARE VISIBLE.

1. Never diminish the corrector as the range of the crest is increased, but rather increase it for the final ranges.

2. If the slope be not steep employ echelon fire at three or four ranges varying by 50 meters.

If the slope be steep, use echelon fire with 25 meter variations.

WHEN THE FLASHES ARE NOT VISIBLE.

1. If the slope be gentle, use echelon fire with 100 meters variation in range, diminishing the corrector by 1 only for each 100 meters increment in range.

2. If the slope be an average one, use echelon fire with ranges varying by 50 meters and diminish the corrector by 1 for each 50 meters increment in range.

3. If the slope be steep, use echelon fire with 25 meters variation in range, diminishing the corrector by 2 on passing from each range to the next, and firing at each range a second salvo or volley with the first corrector diminished by 3.

Then follows a method for determination of slope based upon observation of the balls of smoke from percussion bursts, which have a

height of about 4 meters. Starting at the range of the crest and increasing the ranges in succession by 25 meters, percussion shots are fired so long as the tops of the balls of smoke can be seen. From the total increment in range and the height of the ball of smoke, he deduces the angles of slope. Of this method, the author says that it must be admitted that it will not always be successful. "But at least these means will be available to those who have carefully studied them before hand, whereas battery commanders who have given no previous thought to the subject will be at a loss to know what to do when opposed by an enemy so placed, or they will expend the greater part of their ammunition without result."

In Chapter III, relating to fire with explosive shell, the author criticises the French regulation method of firing against artillery whose flashes are visible behind a crest. This method is to find a 100 meter bracket on the covering crest; then starting with a range 50 meters greater than the long range of the bracket, use ranges with decrements of 25 meters each until it is seen that the shots are certainly short. This method, he says, has the advantage of simplicity, but it requires a large expenditure of ammunition and covers the ground in the opposite manner from that required by the degree of slope. He advocates instead a method dependent upon the comparative visibility of the hostile flashes and the balls of smoke from percussion shots. Of the practical value of such methods, however, the author himself seems to have some doubt, for he closes this discussion with the following remark: "This method, we repeat, is not as simple as the regulation method, which we have no intention of condemning; but it has, as compared with the latter, the great advantage of beating the exact ground occupied by the target, and of avoiding, in the case of gentle slopes, for example, a fire for effect wholly ineffective."

The author next considers the attack of the matériel of a battery which is visible at a range of 2,500 meters. Under the supposition that proving ground deviations will be doubled in service, and that the fire is adjusted so that the mean trajectory passes through a point situated at a distance of once the probable vertical deviation above the top of the target and at a distance of once the probable lateral deviation to the right or left of the center of the target, he shows that 1 shot in 33 may be expected to hit the target at 2,500 meters range; 1 in 100 at 3,500 meters, and 1 in 166 at 4,000 meters. Since at 3,500 meters, 400 shell would then be required to destroy the battery, whereas 664 would be needed at 4,000 meters, he considers 3,500 meters as the maximum range at which fire for demolition should be undertaken with the 75 mm. gun. Apropos of this, he remarks: "It is essential that officers should have a thorough knowledge of this matter in order that they may not begin without due consideration a fire for demolition which would require a greater expenditure of ammunition than they had estimated."

In Chapter IV, he discusses fire over ground sloping down toward the battery. His conclusions are that the best method of attacking a rapidly moving target, artillery or cavalry at the gallop, will be "either to diminish the range of the crest by 400 and execute progressive fire with a corrector corresponding to the mean range, or else to keep to the range of the crest decreased by 400 in order to form a barrier in front of the target," and in case of infantry targets, "take care not to be timid in diminishing range."

In Chapter V, fire against obstacles is discussed, and the amount of ammunition required for demolition is deduced.

Handbuch der Waffenlehre. 3d Edition. Major Berlin. Berlin, E. S. Mittler & Son, 1912.

The general plan of this book is much the same as that of other works on the subject; it is notable only for its completeness. The preface is dated August, 1911, and the writer has sought to present a picture of the state of the art up to that date. New chapters on balloon guns, range finders, grenades, and instruments for observation and communication, are added in this new addition. German matériel and methods are described fully, and with some attention to historical development; considerable space is given to the armament of other European countries.

Mountain Warfare in Winter. H. Czant. Vienna, Seidel & Son, 1911.

The writer, an Austrian captain of infantry, has devoted himself for some years to military exercises in winter, on skis, snowshoes, etc., and has published several books on the subject. The present work, a pamphlet of 80 pages, illustrated by many photographs, describes the methods used in many winter exercises, but the most important part deals with the transport of mountain guns on sleds made of ordinary skis. Each sled is drawn by cannoneers on snowshoes, with officers, etc., on skis; the skis are considered better for individuals, but can not be used when drawing a heavy load, as they slip back too easily.

Fourth Field Artillery Notes, Nos. 3-5. Fort Russell, Wyoming. Regimental Press, 1911.

Three more in the series of leaflets noted in the December Journal. The titles are: No. 3, Notes on the Parallax Method; No. 4, Approximate Equations for the 2.95" Gun; No. 5, The 2.95" Gun *versus* the 3" Gun (both behind masks).

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- 2d Regiment (Mountain).*—Col. John Conklin: H. Q. and 2d Bn, Vancouver Barracks, Wash.; 1st Bn, Manila.
- 3d Regiment (Light).*—Col. Charles G. Treat: H. Q. and 1st Bn, Fort Sam Houston, Texas; 2d Bn, Fort Myer, Va.
- 4th Regiment (Mountain).*—Col. Alexander B. Dyer: Fort Russell, Wyoming.
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- Unassigned*.
- New Hampshire*.—Btry A, Capt. Edwin L. Towle: Manchester.

ACTIVE MEMBERSHIP PERCENTAGES, FIELD ARTILLERY ASSOCIATION.

3d Regiment	95
4th Regiment	89
Unassigned officers, U. S. F. A.	89
6th Regiment	84
5th Regiment	76
1st Regiment	76
2d Regiment	76
5th Militia District	59
1st Militia District	57
2d Militia District	43
3d Militia District	40
7th Militia District	36
8th Militia District	36
6th Militia District	29
4th Militia District	20

In order that the above table may be corrected before each issue of the Journal, Militia commanding officers are requested to keep correct lists of their officers constantly on file in the Secretary's office. Where such lists are not furnished, the batteries are taken, in calculating percentages, to have full complements of officers.

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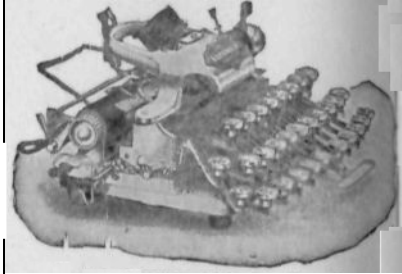


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