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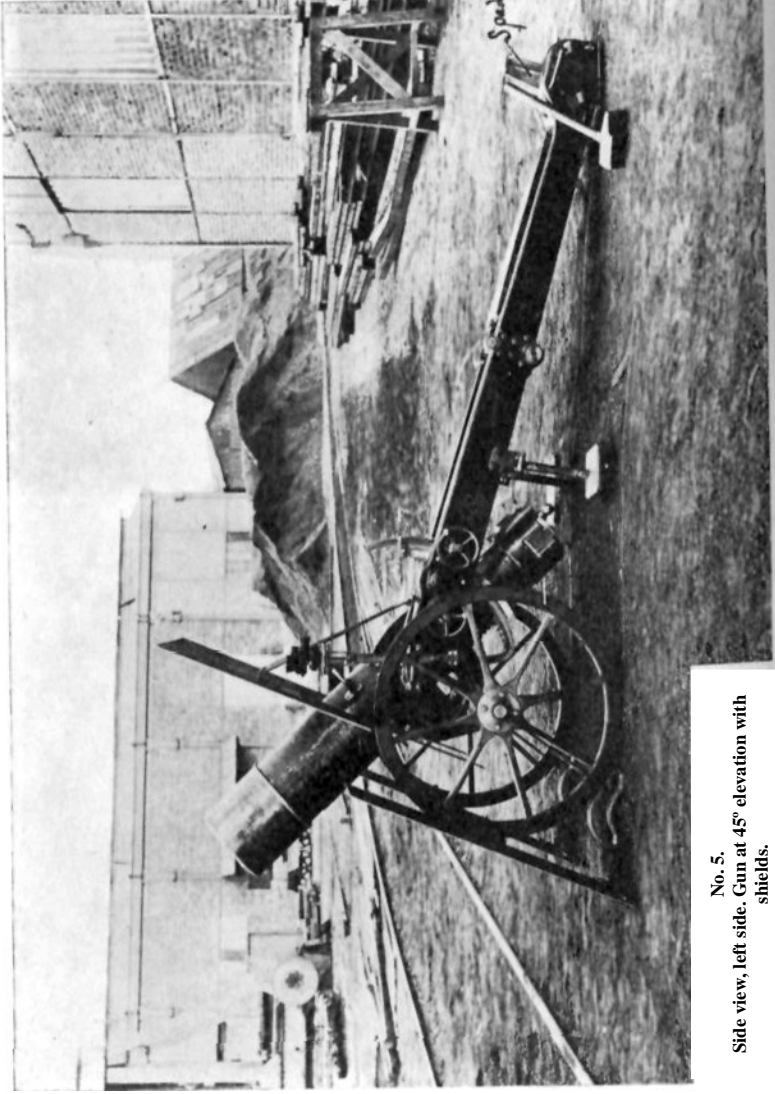
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No. 5.
Side view, left side. Gun at 45° elevation with
shields.

The Deport Mountain Gun.

The Field Artillery Journal

Vol. II

APRIL-JUNE 1912

No. 2

FIELD SERVICE EXERCISES FOR A BATTALION OF LIGHT ARTILLERY

BY G. AUBRAT. MAJOR OF FIELD ARTILLERY.

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(CONTINUED FROM MARCH NUMBER.)

Exercise No. 3.

The major acts as director and as battalion commander; he is assisted by the regularly detailed agents of communication.

Each captain commands his own battery, which is represented by a corporal, a trumpeter, two chiefs of platoon and two caisson corporals.

Lieutenant A commands the battalion reserves. He is accompanied by the regulation number of agents and scouts. Each battery reserve is represented by a commander, an agent and two caisson corporals.

Lieutenant B commands the ammunition train company, and has the regulation number of agents and scouts. Each battery furnishes a platoon of the company, represented by a chief and two caisson corporals. All wear white cap covers.

The details assemble at 8 o'clock, on the Versailles—Sceaux road, just beyond the municipal toll-gate.

GENERAL SITUATION.

The battalion being in action, replenishment of ammunition becomes necessary. Each battery draws from its reserve, and the reserve is then resupplied from the ammunition train.

Arriving at the rendezvous, the director forms up the details as follows:

A.—*Director's agents*.—Front rank, agents of the three batteries; rear rank, agent of the train company and the trumpeter.

B.—*Firing batteries*.—Front rank, battery commanders; rear rank, in rear of each battery commander his own corporal, trumpeter and two caisson corporals.

C.—*Battalion reserve*.—Front rank, Lieutenant A, commanding, with the commanders of the battery reserves on his left; rear rank, in rear of Lieutenant A, a sergeant as agent of communication with the battalion commander, a corporal and a trumpeter; in rear of each battery reserve commander a corporal as agent and two caisson corporals.

D.—*Ammunition train company*.—Front rank, Lieutenant B, commanding, with the three chiefs of platoon on his left; rear rank, in rear of Lieutenant B, two agents of communication; in rear of each chief of platoon, six caisson corporals.

SPECIAL SITUATION NO. 1.

The battalion belongs to the main body of a division which is in action. The battalion opened fire at 7.30; it is now in position five or six kilometers east of here. This ammunition train company is ordered to supply ammunition to it. The company passed through Versailles early this morning, as part of a larger column; its orders are to move out on the road to Sceaux, but not to go beyond the side road to Porchefontaine without further orders.

The director gives Lieutenant B the following orders:

"Assuming that you have just reached here, select a position for your company, and post your details to mark it."

Lieutenant B posts his carriages on the foot path on the south side of the road.

COMMENTS OF THE DIRECTOR.

"Between the toll-gate and the Porchefontaine road, the road is bordered on the right by the steep slopes of the Bois des Gonards,

and on the left by buildings, walls and marshy meadows. The park can not be formed near the road, so its position must be either on the foot path or some distance away, for instance, in that field 600 meters off." (The director points to a field just west of the Porchefontaine road.)

"The road being very wide, the first solution is possible, but I prefer the second. If it be adopted, however, the park will not be easy to see, and the guidon should be left on the road. I might add that, if the carriages are to remain on the road, I should place them on the left side instead of the right. Otherwise troops passing on the road might prevent them from reaching the Porchefontaine roads, or from moving forward on the left side of the road to join the batteries. This is a small matter, but worth mentioning."

Lieutenant B forms his park in the place designated, and returns to receive further orders.

SPECIAL SITUATION NO. 2.

The director continues as follows:

"To save time, we will assume that communication is established between the artillery commander and the train company. This will save an hour,—thirty minutes for the details representing the batteries to reach their positions, and thirty for the agent of communication to come back.

"It is now 8.20. The batteries will move forward; the train company will assume that it has been here since 7.30 and that artillery fire is now heard from about six kilometers to the east. In about ten minutes the company will receive orders to move forward; the agent who brings the message is assumed to come from the battery position. This position has been shown him, and he will be able to act as guide."

The director then moves out the battalion to reinforce another which is assumed to be in position between Villacoublay and Dame Rose. He himself, as battalion commander, goes ahead on reconnaissance, leaving orders for the battalion to follow at a trot, and posting agents to make the road. Having gone 1,000 or 1,500 meters, he sends a sergeant back to the train company with the following order:

"The second battalion is in position northeast of Vélizy; bring

up your company as soon as possible to supply it with ammunition. Do not go beyond the point where the road to Vélizy branches off from the Sceaux road."

On receipt of this order, Lieutenant B moves his party out at a trot on the main road, guided by the sergeant who brought the order. At the Pont Colbert he calls up his senior chief of platoon and senior agent, and gives them the following orders:

To the chief of platoon:—"Take command of the column and follow me at a trot."

To the agent: "Mark my route, using the other agent and the scouts."

Lieutenant B then goes on at a fast trot to the Vélizy road, where the agent shows him the positions of the firing batteries and reserves. He decides to form his park just north of the Sceaux road and west of the Vélizy road (Fig. X'). The reasons for this decision are:

1.—It is about 1,600 meters from the batteries, and concealed from the enemy by the crest between Vélizy and Villacoublay.

2.—The space is ample.

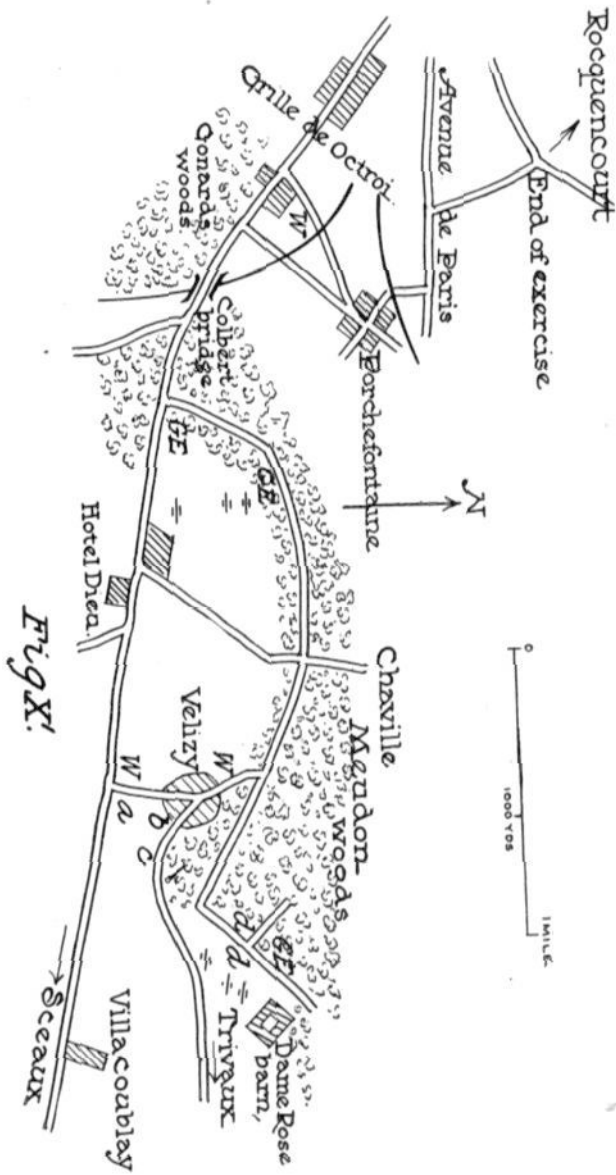
3.—The ground is hard.

4.—The two roads furnish good communication, both to the front and rear. The road ditches, however, are an obstacle, and as soon as the park is formed it will be advisable to prepare four crossings, two for each road.

The men are posted to outline the park. The formation is in column of platoons at 12 meters distance; the interval between carriages is 3 meters.

As soon as Lieutenant B has selected the place for the park, he sends the agent who has acted as his guide back to rejoin the artillery commander, and his own two agents to the battalion reserve.

Meanwhile, the batteries have moved forward at a trot four or five kilometers. They are placed in position in the edge of the Bois de Meudon, and simulate fire in the direction of Trivaux farm. No orders are sent to Lieutenant A, commanding the battalion reserves; he, however, drops out of the column at the proper time, and then halts far enough away not to interfere with the firing batteries. Having looked over the ground, he posts the reserves on a wood road and in a clearing, 300 or 400 meters in rear of the guns.



After the simulated firing, the director takes up replenishment of ammunition.

The first step is to replace the empty caissons of the fifth section in each battery by full ones from the reserve. An agent carries orders to Lieutenant A to send up two caissons to each battery. Two caisson corporals from each battery reserve join the firing batteries, and the caisson corporals of the fifth sections return to the reserve.

About this time the three agents sent by Lieutenant B arrive. One reports to the artillery commander; the others inform the commander of the reserve of the arrival and position of the train company.

Although the director receives the same information, he gives Lieutenant A no instructions as to replenishing his ammunition. It is the business of the reserve commander to attend to this; he has empty caissons, and should exchange them for full ones at the first opportunity.

Lieutenant A, then, as soon as the agents report to him the arrival of the train company, sends one of them back with an order for six caissons. A non-commissioned officer, guided by the agent, brings up six mounted men by the route marked *abcd* in Fig. X'. They move at a trot, according to the general rule,—that all movements to the front shall be at a trot, and all movements to the rear at a walk while in sight of troops in action.

Shortly after sending up the six caissons, the commander of the train company receives the following message from the artillery commander:

"The batteries are about to retire. Fall back upon Versailles by the main road."

Lieutenant B waits a few minutes for his six caissons, then, as they do not appear, leaves park and moves at a walk toward Versailles, on the main road; he leaves a non-commissioned officer to bring on the six caissons when they return. The caissons soon rejoin, and the column is formed as at the outset. The order of march is,—1st, 2d and 3d platoons, scouts, agents, and finally the commander of the company, who keeps some distance behind his last carriage.

Approaching the Hotel-Dieu, the company commander, not having yet seen anything of the battalion, decides to halt and send an agent of communication to look for it. The halt is made on the

road, just west of a little patch of woods where the road from Chaville comes in. Before the agent has started, however, the battalion is seen coming out of the Bois de Meudon by the Chaville road; the company takes up the trot and starts for Versailles.

On the way, an order reaches it to go to Rocquencourt by the shortest route, but to avoid passing through the main streets of Versailles. The column takes the Porchefontaine road, the Avenue de Paris, and a road leading to the intersection of the Avenue de Saint Cloud and the Avenue de Picardie, where it halts.

The battalion takes the main Versailles road, and is halted in rear of the Bois de l'Hotel Dieu. The battalion and battery commanders reconnoiter positions, and the batteries are placed in observation, one in rear of the Bois de l'Hotel Dieu, the others 500 meters to the left, close to the Bois de Meudon. The reserve of the first battery is in rear of it; those of the other two are in a clearing in the Bois de Meudon.

The batteries simulate fire, and then withdraw by echelon. The 2d and 3d Batteries return to the main road through the woods, and continue the march by the same route as the train company; the 1st Battery remains in position a little longer, and then follows the others.

COMMENTS OF THE DIRECTOR.

The party is reformed at the intersection of the Avenue de Saint Cloud and the Avenue de Picardie, in the same order as at the first assembly. The director asks such questions as are necessary to complete his information, and then takes up the critique as follows:

"The mistakes made by the officer commanding the train company are all due to one cause,—he was too much afraid to leave his command. This led to faulty dispositions no less than three times.

"First, he formed his park on the Sceaux road near Vélizy, without knowing just where the batteries and the reserves were posted. Secondly, he selected for his caissons a road that was neither the shortest nor the best concealed (*abcd*, Fig. X'); there was a better road through the woods (*abc'd'*). Thirdly, he halted near the Hotel Dieu instead of going on toward Versailles, because he was ignorant of the retirement of the batteries by the road in the edge of the Bois de Meudon.

"He would have done better to keep far ahead of his column as it moved up on the Sceaux road, so as to come opposite Vélizy five

or six minutes before it. Here he should have posted a scout to halt the column, while he himself, with the artillery commander's agent, went ahead to see just how the battalion was posted. On his way back he should have selected the place for his park; and he would undoubtedly have put it close to the southern edge of Vélizy, where it would have been well concealed, near the battalion, and in easy communication with it.

"If he had taken this position, then even if his subordinates had not themselves found the best route to the battalion reserve he would have been in a position to show it to them.

"Finally, when he received orders to fall back upon Versailles, he could have observed personally the movements of the battalion, and, if necessary, asked further instructions from the artillery commander.

"The principles that should guide the officer commanding a train company are as follows:

"1.—During marches on the battlefield, since he generally has to make the selection of position for his park, he should not be tied to his column. He should leave it in charge of his senior subordinate, and himself remain free to reconnoiter, having scouts mark his route if necessary.

"2.—The park should be where there is ample space and firm ground, concealed and sheltered from the enemy. If no suitable place can be found, it may be on the road, but in this case great care should be taken not to interfere with movements of troops. There should be no bridge or defile between the park and the batteries, if it can be avoided.

"3.—The first park should be formed about 5 kilometers from the fighting line, and notice sent to the commander of the artillery.

"4.—The second park should be about 1,500 meters from the line, and agents should be sent to the artillery commander and to the battalion reserve.

"5.—The company commander should never fail to keep himself informed of the position and movements of the batteries. To this end, he should leave his company, remaining, of course, in communication with it through agents. If, when the batteries change position, he receives no orders, he should ask for them; in emergencies, he should take such steps as he considers necessary without waiting for orders.

"6.—As a rule, he should go around villages instead of through them, to avoid danger of being blocked in the streets.

"These principles were not all illustrated in today's exercise. But I wish to repeat that the errors made were all due to lack of initiative; and in the remaining exercises it is this quality that I particularly wish to develop. The situations will be made less definite. The train company will operate in more broken and difficult country; its orders will be vague, or it may receive no orders at all.

"I am emphasizing so strongly this point of developing initiative, since it is so important for all grades,—not only for officers, but for non-commissioned officers, and even for trumpeters and privates. On the battlefield, the artillery commander is on the firing line, directing the action; he is handling battalions of artillery, and ammunition trains. His task is difficult, even when he is ably seconded; with so much to think of, he can not remember everything. Hence no command can be considered well instructed until everyone knows just how much of the responsibility rests upon him, and does not hesitate to ask for orders, or even to correct, on his own responsibility, any errors or omissions of others that may come to his notice."

SIXTH SERIES.

Exercises with Matériel.

Before describing these exercises, we have thought best to give an outline of some of the lectures given by the major as an introduction to the series. In these lectures he describes the procedure to be followed, repeats some of the remarks made in his previous critiques, so as to avoid a repetition of the same mistakes, and seeks to establish uniformity of doctrine in regard to fire, etc.

LECTURE NO. 1.

The instruction of artillery personnel includes (1) battalion firing exercises, on the range and in the field; (2) field service exercises, with and without matériel; and (3) map work.

Today's lecture will deal with preparation for exercises with matériel, and will explain the reasons for the methods of instruction

adopted. Before speaking of the details of the various exercises. I will discuss the general principles upon which they all depend.

1.—Every exercise has a tactical theme. This you have already observed in our previous exercises, and you doubtless appreciate how the tactical situation is the controlling element in them all; but perhaps you do not yet realize that the same thing is true of firing practice, and that instruction in methods of fire can not be separated from instruction in the application of fire. I will revert again to this point; opinions still differ upon it. Until within a very few years neither the regiments nor the schools of fire, in teaching mechanism of fire, made any point of its use in battle.

2.—The themes are so prepared as to include a general situation which gives rise to various incidents of an action. This action is given a logical development, and pictures are presented to the officers concerned which require them to deal with special situations. The theme is not a fanciful story ending in a firing problem, but it is the explanation of a military situation which each officer must fully comprehend in order to act intelligently when the development of the action requires him to make any decision, and particularly when he is required to conduct or simulate fire.

The theme should be fitted as well as possible to the ground, for this makes the situations clearer and more natural, and makes it possible to find reasonable and natural solutions.

Since the purpose of the theme is to define a general situation for the artillery and the troops with which it is directly concerned, it is not desirable to bring in assumptions which do not bear directly upon the subject. If the problem is one in battalion fire, the director should mention only such things as the battalion commander needs to know. It is immaterial to say that the army is coming from such and such a place 200 or 300 kilometers away; that the commanding general means to envelop the enemy's left, etc. What may be happening somewhere else does not interest the battalion commander; what he wants to know is, whether the infantry force with which he is operating is to attack vigorously and drive the enemy from his position, or remain where it is, in a threatening attitude, to hold him, or break off the action after a time and retreat. In our exercises, then, the officers must always be kept perfectly informed to this extent; they must always know the distribution of the infantry, the artillery positions, the positions of the enemy, the progress of the attack, etc.

3.—The exercises must be conducted in such a manner as to require officers to solve such problems as they will encounter on the battlefield; the directors must take pains to make their problems realistic. Starting from the general situation, they should develop the action by presenting a series of realistic pictures, creating situations which will call for quick decisions and suitable orders.

Artillery commanders require a special training in formulating their orders. However clear and simple the situation may be, practice is necessary to enable them to translate their thought into accurate and complete orders as soon as they have reached their decisions. Directors should give much attention to this matter of orders. They should take every means to prevent officers from being content with vague instructions; they should require everyone to give his own orders clearly, and, if he receives incomplete or uncertain orders, to call for further information.

In a word, the best exercise is the one which most clearly simulates an actual engagement, and requires officers to give orders as they will have to do in the next war. It should give a picture of war, as realistic as can be given in time of peace. Officers can thus learn to form quick decisions as soon as a situation presents itself, and to translate this decision without hesitation into clear and concise orders.

4.—From the foregoing, one might conclude that there is only one way to conduct exercises in the field. Nothing could be farther from the truth; the exercises should be progressive, following in regular sequence. The method of conducting them depends upon the state of instruction of the personnel, and upon the difficulty of the problems, according to the tactical situation and the terrain.

Thus, an exercise may be merely a conference in the field, conducted by the director, in which he develops each situation and the problems resulting from it, and gives the solution which he proposes. Others may be managed like maneuvers. The director organizes the party and assigns duties to each officer. When the action has begun, he merely gives orders and describes what would in reality be seen and heard; each officer then has to deduce the actual situation and make his dispositions accordingly.

Evidently this second type of exercise, which compels the officers to deal actually with the difficulties inherent in the command of artillery, is much the more instructive. It is the model exercise,

and should always be used when possible; the conference may take its place when nothing better can be done.

5.—The handling of artillery on the battlefield depends upon the situation; every case is a special case, to be treated as such. But it is possible to outline the habitual procedure, as a typical case to which the special cases will approximate more or less.

Let us imagine that an engagement has begun, and that the advance guard artillery battalion is already in action. Let us then follow the course of another battalion sent up to reinforce it, which may be considered as the typical case.

As soon as the artillery commander receives his orders from the commander of the troops, he makes his dispositions for getting the new battalion into action. We will assume that the batteries are some distance in rear. The artillery commander sends orders by an agent to the battalion commander to join him, letting his batteries follow; he then looks over the position and decides upon the orders to be given. The agent delivers his message to the battalion commander, who turns over the command to his senior captain and starts to join the artillery commander, guided by the agent, and posting men to mark his route.

When the battalion commander reports, the artillery commander gives his orders in such a manner as to explain the whole situation. He points out the positions of both friendly and hostile troops, and explains the intention of the commander. He then defines the part to be played by this particular battalion, points out the positions to be occupied, and gives such information as may be necessary concerning fire direction,—sector of action, choice of targets, when and how fire is to be opened, etc.

The battalion commander in his turn makes his detailed reconnoissance, and decides what is to be done. He then sends for his captains and gives them their orders, in such form as to put them in touch with the situation. He should tell them the work assigned to the battalion, and, if necessary, to each individual battery; the position of the battalion and of each battery; prescribe how the position is to be occupied; and decide all the questions involved as to fire direction,—registration point, station of battalion commander, order of opening fire, choice of targets, etc.

Each battery commander then makes his reconnoissance and gives his orders. At a given signal, the batteries move into position.

Preparation of fire is completed as rapidly as possible, and, according to circumstances, fire is opened or the batteries remain in observation.

In getting his batteries into position, every artillery commander will always have to give an order something like the ones outlined above. The form will vary with the situation, but in all cases it should contain sufficient information as to the situation, the work to be done, the position, and the management of the fire. All this information is not always given in the same manner; it is easy to imagine circumstances where there is no time to give it before fire is opened, or perhaps where it can not be given at all. But the artillery commander must think of it, and not omit it except for good reason. The position and the firing instructions must always be given, but if time presses the order may reduce to "put your battalion there, and open fire as quickly as possible upon that infantry."

The same remarks apply to the orders given by a battalion commander to his captains. None of the points specified is superfluous, but their importance varies; the essential thing is, that if anything is left out it should be intentionally, and not through oversight. The battalion commander should always remember the points to be covered, no matter in what form he gives his orders,—whether he calls his captains and goes over the situation with them at length, or gives a few hurried commands and sends additional information later.

The outline for these orders is as follows:

Artillery commander to battalion commander.

Situation.—Terrain, troops, intentions.

Duty assigned.

Position.

Fire direction.—Sector of action, opening of fire, choice of targets.

Battalion commander to battery commanders.

Situation.—Terrain, troops, intentions.

Duty assigned to battalion and batteries.

Position of battalion and batteries.

Occupation of position.

Fire direction.—Repetition of orders of artillery commander, methods of fire, registration point, battalion commander's station.

This outline should be remembered. It will not show you what orders to give, but it will remind you that you must give some orders covering all these points. If you overlook any of them, your orders may be incomplete, and grave consequences may result. It is well to encourage your subordinates to ask for further information, if your orders seem to them inadequate. In fact, it is a good plan occasionally to give, intentionally, an inadequate order, to make your subordinates think. Command in war is almost impossible unless the subordinates do think; for no commanding officer is so sure of himself that he expects to overlook nothing.

In closing, I wish to speak briefly of each class of exercise, to remind you of their purpose and suggest how they should be conducted. It should be noted, however, that if we compare the various exercises, it is not with the idea of eliminating one and devoting its time to another, for all are necessary; it is simply to determine what instruction can be gotten from each, so as to give each the proper amount of time.

The work required of artillery in battle is field firing, consisting usually of an adjustment upon some object in the terrain (the edge of a field, a hedge, crest, edge of a wood, road ditch, trees, bushes, etc.) followed by fire for effect upon troops more or less protected. Our exercises, then, should all illustrate a maneuver in the field leading up to such adjustment and fire for effect.

Battalion field firing is unquestionably the best form of exercise to prepare the personnel of the batteries. Firing on the target range is not as good, since the ground is limited and well known, and besides is usually unnatural in character, being uncultivated plains or clearings in woods, so that adjustment on conspicuous objects is a secondary matter. Besides, on a limited range, the danger of accident prevents realistic work. One can not say to a commanding officer, "here is your problem, solve it as you would in war."

Field exercises with matériel are not always satisfactory. To avoid injuring crops, the directors often have to assign the positions, or, if they do not do this, they draw up the problems in such a manner as to lead the batteries to occupy the positions that they have determined upon beforehand. Officers can exercise little initiative in selecting positions. And, of course, the dispositions are not tested by actual firing.

Exercises without matériel have the same defect, in still larger degree, since the solutions can not be tested either by the execution

of the maneuvers or by firing. But they give practice in dealing with actual situations in the field, and more initiative can be allowed the officers, since the choice of positions is less restricted.

Map work is merely an elementary exercise intended as a preparation for the other exercises.

The procedure in conducting *battalion field firing* should be somewhat as follows:

The assignment of the duties of officers should be made beforehand. At the assembly, the director assembles the officers and states the general situation. The exercise proceeds as explained above. The director, as commander of the force or of the artillery, gives orders and states new situations, trying always to keep the officers concerned informed to the same extent that they would be in war, and making use of all the peculiarities of the ground and all the targets available.

Officers are left free to act precisely as they would in service. The director interferes as little as possible with their selection and occupation of positions, and with their preparation and conduct of fire. He merely reserves the right to decide in each case whether the fire shall be real or simulated.

Thus, the director joins the commander of a battery in observation, and states a situation. The captain gives commands for such firing as he thinks proper, but instructions are given beforehand that ammunition is not to be used without express orders. When the director sees that there can be no danger, and that the fire will be of interest, he authorizes the use of ammunition. Thus all proposed solutions are accepted and tested. The critique is merely an opportunity for indicating the solution believed to be best.

Battalion range firing should be conducted in as nearly the same manner as possible. On large reservations, such as have recently been fitted up, the results may be very good; on small ones the firing can be only elementary.

Field exercises with or without matériel imitate as closely as possible the exercises in field firing. The director defines the situations by giving orders, in the character of the commander of the force or of the artillery, and by describing to the officers what they would see and hear in service.

It should be remembered that even in exercises without matériel all the operations preceding the arrival of the batteries are executed precisely as for firing. The difference is that the dispositions can

not be actually tested, and the director has to draw upon his experience in estimating them. Hence, when the simulated occupation of position is completed, the director should require the most minute and accurate statements of what each officer has done, and not proceed to preparation and conduct of fire until he understands exactly how the guns are placed. He is then in a position to judge the solutions.

When firing is taken up, all the officers are assembled, so that they can follow the course of the action and profit by the comments made.

All this applies equally to exercises with and without matériel. It is evidence that those with matériel would be much the more valuable, if it were not for the restrictions imposed by regard for crops. Conditions being as they are, the exercises with matériel are more valuable to the troops than to the officers.

In *map work*, the director tries to formulate his situations so as to call for decisions and orders as in the field. But there is too much imagination required, and the work is not as satisfactory as out of doors. There is the advantage, however, that the officers do not have to think of distance, of their horses, of bad weather, etc., and can reflect more at their ease on the solution of their problems and the formulation of their orders. For these reasons work on the map is an excellent preparation for work in the field.

LECTURE NO. 2. EXERCISES WITH MATERIEL.

In any instruction work, the first essential is to get all the minds working along the same lines. Thus, in a battery, the best work is done when every man, officer, non-commissioned officer or private, knows what is being done and understands the application and the importance of it. When this is the case, everyone tries his best to improve himself. In this lecture I wish to put you in this attitude toward the series of exercises which we are about to begin.

An exercise of this class is a maneuver on varied ground for one or more batteries, in which are combined all the different operations which we practice in the course of a year's instruction, with the exception of actual firing. It includes generally reconnaissance and occupation of position, preparation for observation of the field, simulated firing, replenishment of ammunition, etc. The enemy may or may not be represented. It is an excellent preparation for

war, for, unless hampered by the state of the crops, we can imitate service conditions very closely.

Such exercises should hold an important place in our instruction programs. They are indispensable for preparing both officers and enlisted men for war. They are the best possible introduction to field firing, and they give the opportunity to practice handling a complete unit, with scouts, etc., frequently and at all seasons of the year.

Thus they are useful in many different ways. At the beginning of the instruction year they set both officers and enlisted men to thinking along certain lines. They prevent instructors from wasting time on things of no importance, by recalling to their minds the ultimate object; and they show the men what the instructors are aiming at, and help them to understand why certain things are insisted upon. At the end of the year, they show the maneuvering power of the battalion, and make it a reliably trained unit, with confidence in itself and in its commander.

These exercises should be used from time to time as a change from those without matériel, so as to correct false ideas of the mobility of artillery and of the rapidity of transmission of orders, make the maneuver and the preparation of fire more realistic, and permit a better estimate of the propriety of the dispositions.

This work should not be limited to any one season. Wars are fought at all times of the year, and, since the method of using the ground differs at different seasons, officers should be accustomed to field work at all times. Frequently the same problem takes on an entirely different aspect if tried at a different time of year; a position that is of but little strength in winter may become very strong in summer, when the crops are high and the trees in leaf.

With some precautions, we have been able to do field work at all seasons, in the country around Poitiers and Versailles, although these regions are thickly settled and under high cultivation; the damages paid have been very small, and, in fact, we have been in the field near Versailles more than two hundred times in a single year without paying any damages at all. The only thing necessary is always to consult the owner of the ground beforehand.

In the spring, the ground is bare, and if it were not for the damage to crops this would be a very favorable time for these exercises. But the ground that can be used is limited, and the plan and execution of the exercises must be limited accordingly. The director

should, however, require all orders to be actually given, and their execution begun; if he sees that damage will be done, he can stop the movement at the last moment. Preparation of fire can be made, whether or not the guns are put in position.

The same difficulty is encountered in summer, but this is no reason for not attempting the exercises. It is only necessary to be more careful, and to take greater pains to find suitable ground. The view is often limited by trees and standing grain, and it is very desirable to get this kind of practice under these conditions.

Autumn is of course the best season. The crops are mostly off, and, the ground being generally hard, movements off the roads are easy. The elementary instruction is over, and the maximum number of trained men is present.

In winter there are many good opportunities for this work, if they are seized promptly; the battalion should be kept ready for it at a moment's notice. When the ground is frozen and covered with snow, the whole country is one great maneuver ground, and the question of damage to crops does not arise. If the weather is wet, it is difficult to move off the roads, and often impossible to cross ploughed ground; all the cannoneers of a platoon are sometimes required to move a single piece or caisson; rapid gaits are impossible, and artillery can not be deployed as in the autumn maneuvers. These are all conditions that officers should encounter practically. An officer can not make a reconnaissance properly unless he knows just what can be expected of men and horses.

In order to decide upon the proper organization for these exercises, let us first consider what are the requirements, and then how these requirements may be met.

The battalion is the tactical unit of artillery. In general, then, our problems should be for the battalion. Batteries act alone only exceptionally, and when they do it is generally in support of infantry. Our problems, then, should fall into two classes,—for the battalion and for the infantry battery. There should be at least two exercises a month, on the average, and of these three or four should be of the first class to one of the second.

The battalion has not enough men and horses to turn out all three batteries complete. To do this it would be necessary to combine two battalions, which is usually not practicable. The greatest shortage is in non-commissioned officers; for not only must the service of the batteries be provided for, but also the battalion and

battery reconnaissance parties, scouts and agents. Part of the battalion, then, must be outlined only; this may be arranged in several ways.

One battery may go out complete, with all its guns and four or five caissons. The other two batteries may be represented by guidons, or by the chiefs of platoon and section, the sights being set up on tripods to mark the guns. If the reserves are to be considered, they may be represented in the first battery by two caissons and two flags; in the others by two flags.

Another plan would be to let each battery have one platoon or one section, the other sections being represented by sights on tripods. Each battery reserve may be represented by a caisson or flag.

Or, the three batteries may be turned out in different ways. For example, one battery may have its four guns and five caissons; the second may use the sights; and the third may be represented by two flags, marking the right and left, or head and tail. The reserves may be represented in any of the ways mentioned.

The major and the three captains should act in turn as directors, preparing the plan and prescribing the organization according to circumstances. For example, a piece of fallow ground may be found, where there is room for one battery but no more. Here one battery might go out with its carriages, and the other two be represented by flags, which could be carried by men on foot into places where the carriages and horses would do damage.

If desired in any particular problem, the director may place flags to mark the assumed position of other battalions.

For the benefit of instructors, it would be well to point out some of the most common mistakes. If these can be avoided, the earlier problems will be more profitable, and we shall be able to carry the instruction farther.

1. —So far as possible, every man taking part in an exercise should understand the general situation, and have a working idea of the process of solution. It often happens that, in his haste to execute a movement, an officer neglects to inform his subordinates of the situation, and thus causes serious mistakes, even compromising the success of the whole plan. For instance, a captain receives orders to occupy a position behind a crest, with mounted defilade. The enemy's artillery is in observation, and the movement has to be concealed from its observers; the slope is sharp, and it is not safe to go even a few meters in front of the guns. The

captain sends for his battery and brings it into position, without explaining anything. Some of the limbers get too far to the front, and expose themselves. This can be prevented, if, before approaching the position, the men are cautioned that they have only mounted defilade, and that the enemy is in observation, and that consequently the line of guns must not be crossed.

2.—Scouts must be kept fully informed of all the successive situations. They must clearly understand the landmarks (roads, streams, woods, etc.) that mark out their own field of action at all times. Otherwise they are likely to act without regard to anyone else, and destroy the realism of the exercise.

3.—Order and cohesion are indispensable. To get them, certain points must be carefully watched.

Insist upon absolute silence. Give all orders and information in a low voice; only the voices of the battalion and battery commanders should be heard. Require the use of the regulation gaits, both for formed bodies and for individual carriages and mounted men. Require limbers to march well closed up. When chiefs of platoon and gunners are ordered to report to the battery commander, require them to come up in order, and arrive together. Permit no carelessness in handling the pieces.

4.—In battle, confusion is inevitable; in instruction, it should be produced artificially, and the men trained to get in order again quickly. Frequently, while a battery is firing or getting into position, men or horses should be designated to fall out; or units should be intentionally mixed.

5.—In service, batteries will remain for long periods in observation, without firing. In instruction, it would be a mistake to leave them idle even a short time. The director should not hesitate to say,—“We should probably remain here in observation a long time; we will assume that an hour has passed; the situation is now as follows.”

6.—Limbers are often placed too far from the guns; it may at times happen that, in a partial retreat, they may be led to abandon them. Hence, when the action takes an unfavorable turn, it is well to bring them closer.

7.—In battle, a battalion rarely maneuvers alone. We should always assume that the position where we place a battery or a battalion is or may be occupied by others also. Consequently, the reserves should be placed directly in rear of the battalion. The

commander of the reserve always has a tendency to go to a flank; but this is possible only under exceptional circumstances, as in the case of an advance guard battalion, or where the nature of the ground makes it necessary to leave gaps in the line of guns.

I think it will be useful to mention some of the most conspicuous mistakes that have been made in the course of the exercises we have just been having. As you will see, these mistakes were all due to failure to keep in mind the details of the concrete case under discussion,—the duty of the battalion, the ground, the state of the air, the military situation, etc. We must accustom ourselves to giving due weight to all these details; even when we do our best, there will necessarily be many arbitrary assumptions in maneuvers, which will prevent us from acting precisely as we should in war.

1.—The degree of visibility should always be considered. Suppose, for example, that a battalion is ordered into a position in observation, under such circumstances that it must avoid being seen. It takes position with drivers dismounted, the guns are placed by hand, and fire is simulated. An hour later, the condition of the atmosphere having entirely changed, orders are received to send a battery forward rapidly. There is now a thick fog, hiding not only the enemy's artillery position at 2,500 meters range, but even the woods 1,500 meters ahead, on a line with our infantry. This being so, the battery can safely limber to the front with drivers mounted; it is a mistake to limber rear, moving the guns by hand, and bringing up the limbers with drivers dismounted.

2.—Judgment is necessary in selecting the line of defilade. Suppose, for instance, that a battery is ordered to take position quickly and open fire at once upon hostile artillery which is firing upon our infantry. This artillery is concealed behind a crest, only its flashes being visible. There are a number of fruit trees on the crest, some of them close to the guns; there is also a village just behind, the nearest houses being about 80 mils to the right of the flashes.

The position assigned the battery offers cover enough so that dismounted defilade can be taken with respect to the crest line, or the tree tops, or the roofs of the houses. We have seen all three of these lines of defilade used, but the second is the only correct one.

We must assume that the enemy has made proper arrangements to observe the field. Probably the battery commanders or observers are in the trees. If, then, the first line is used, they will see the

whole movement, and probably the guns when they are in position, and can direct the hostile fire accurately.

There may be observers on the roofs also; but this does not make it necessary to take the third line. Such information as these observers may send in will not reach the batteries until our own battery is ready to fire, and their reports can not be accurate enough to use in fire for demolition.

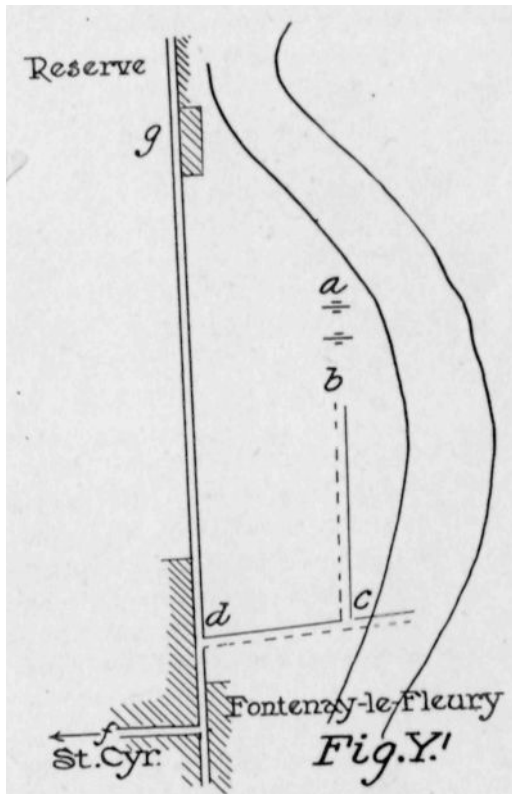
Assuming that the range is 2,500 meters, the slope of the ground 1 on 100, the height of the trees 5 meters, and the height of the houses 10 meters, the distance from the first line of defilade to the second, and from the second to the third, is about 40 meters.

3.—A bold, rapid movement is often better than a more cautious one. Take the case of a battalion ordered into position of observation behind a crest, to be ready to fire upon hostile artillery located by flashes seen behind a crest at 2,000 meters range. The battalion commander wishes to avail himself of cover, to avoid being seen while coming into position, or at least to be able to reply promptly to any fire he may receive.

He decides upon dismounted defilade; and, although there is a tall poplar close to the enemy's guns, he takes his line with respect to the ground at its foot; for reconnaissance shows him that if he took defilade against the top of the tree the guns would be so far back that the battery commanders would find it very difficult to conduct the fire, and time would be lost in arranging the system of communication. He therefore places himself with mounted defilade against the foot of the tree, and sends for his battery commanders. They in turn send for their chiefs of platoon and gunners, indicate the poplar as aiming point, give the initial firing data, and post the gunners to mark the positions of the pieces. The chiefs of platoon then bring up the batteries.

This procedure is inadmissible, as is evident if we imagine an observer looking on from the top of the poplar. Even if the batteries were well trained the process would be slow, and it would all be in plain sight. Counting from the time of arrival of the battery commander at the position, it would be say four minutes before the chiefs of platoon and gunners arrived; twelve minutes before the battery reached the line of mounted defilade; fifteen minutes before it could unlimber and begin to place the guns by hand; and twenty before it could open fire.

The proper plan would be for the battalion commander to come forward alone to reconnoiter, then return toward his column and find a place where he could see both the enemy's battery positions and his own. Here he should give all his orders, thus avoiding any danger of attracting attention to the position his batteries are to take. The battery commanders should then give their orders to chiefs of platoon only, at this same place. The poplar tree could be used both as aiming point and registration point, and it is so conspicuous that



there could be no mistake. The batteries should then take position at a trot, drivers mounted. Attention would not be attracted to the position until the batteries actually arrived; within two minutes they might unlimber, and in a minute more be ready to fire. Then, no matter how good the enemy's system of observation and communication, fire could not be opened upon the batteries while getting into position.

4.—Young officers frequently forget what might be called the psychological aspect of the maneuvers executed. In one of our exercises consideration for the morale of the troops was neglected in two separate instances. The exercise dealt with a rear guard battery, and the situations were as follows:

(a) The battery was partly concealed by a slight rise in the ground (*a c*, Fig. Y'). The reserve and the limbers were 400 meters in rear, concealed by houses along the road to Fontenay le Fleuri. Orders were received to retire upon St. Cyr. The limbers were brought up, drivers mounted; the battery was limbered to the rear, and moved off to the right in section column, following the line *abcde* just behind the crest. It was thus unnecessarily exposed, for it might just as well have moved straight to the rear.

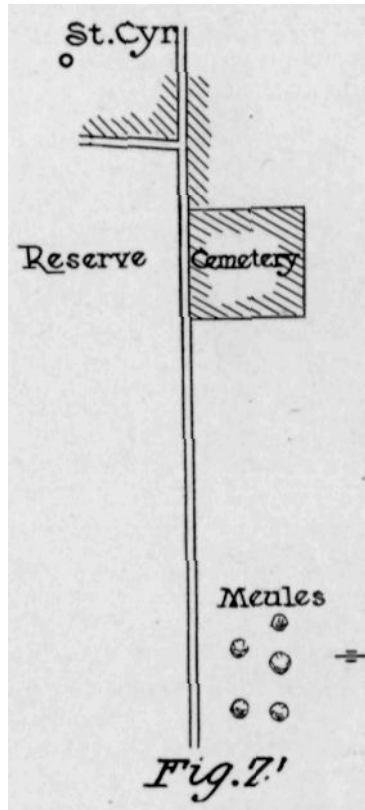
As soon as the limbers came up, the battery commander galloped off to Fontenay, abandoning his battery during its dangerous flank march. He should have remained with the battery until he had gotten it into concealment. The reserve, having no orders, followed the battery, and so passed over ground that it should have avoided, being exposed to the enemy's fire, and likely to be covered with dead and wounded. The line *gdef* would have been much better in every way.

(b) No covered position was available. The guns, partly concealed, stood about 40 meters in front of five large straw stacks (Fig. Z'). The limbers and reserve were 500 meters to the left, behind St. Cyr cemetery wall.

The limbers should have been as near the guns as possible; in this case, behind the straw stacks. In rear guard, the critical moment is when the limbers come up. This moment is always postponed as long as possible, and if special preparations are not made for the movement it may become impossible. Often it may be better, instead of bringing the limbers up, to move the pieces and caissons by hand back to the limbers.

But here, the order to limber having been given, the cannoneers made ready, and the head of the column of limbers came out from behind the wall. At this moment, the battery commander left the battery on reconnaissance, at a gallop, and passed the limbers just as a slight accident, which stopped the leading limber, blocked the whole column. If the enemy had been firing, there is no knowing what might have happened.

The battery commander should remain with his guns, and retain personal command until the column gets out of sight of the enemy. Otherwise he may give rise to the suspicion that he is running away.



Firing Instruction.

LECTURE NO. 1.

Every concrete case is a separate firing problem, and has its own separate solution.

In battle, artillery fires under the most varied conditions, both as regards the military situation and as regards the target, and battery commanders must be ready to meet all these conditions. By this we mean that battery commanders must be prepared to vary their

methods of fire indefinitely, and have as many ways of firing for adjustment, registration or effect as there are concrete cases. The regulations, as their name implies, give general rules; the principles there laid down, the methods of fire prescribed, and the suggestions given as to the employment of these methods, all have in view an average case. All officers understand this, as applied to drill; but how many so understand it as applied to firing?

Analyzing the firing one ordinarily sees, it would seem that many officers look upon the provisions of the regulations as ready-made solutions of all problems of fire. This difference in attitude results, of course, from the fact that we drill a great deal and fire very little. Officers give the firing instruction all due weight, but they practice it only for a few weeks each year.

The regulations provide a method of adjustment; a few suggestions on registration; and four kinds of fire for effect,—fire by piece, salvo or volley, and zone fire. For many officers, the solution of a firing problem consists merely in a choice between adjustment and registration, and then among the four methods of fire for effect. Once having selected a plan, they carry it out to the letter; their firing methods are absolutely stereotyped.

If we think for a moment of the ideas universally accepted in the artillery only a few years ago, we shall not be surprised to find the regulations interpreted in this way. Batteries armed with the 80 or 90 millimeter guns had only one method of fire, which they used regardless of the military situation or of the nature of the target. In service practice, whether the target was a wall, a battery or a line of skirmishers, the battery commander first ranged on the target and then commenced fire for demolition at that range. It was all bullseye shooting. The battery commanders were almost compelled to use the same procedure against all targets, for all targets were alike. The planks of which they were built were, it is true, shaped differently, to represent different objects; but the targets were essentially the same. The fire was always adjusted by observing long and short shots with respect to a wooden target; and when, firing with the range thus obtained, a battery destroyed the target, its work was considered perfect.

Such firing can no longer be considered a sufficient preparation for battle. But habit is strong, and it is hard for officers accustomed to such methods to get away from them. During the last practice season, we often saw batteries adjust their fire, using five, six or

seven salvos, upon lines of skirmishers, standing and motionless. We should never find real skirmishers standing still to let us adjust upon them.

However, until the appearance of the regulations for the 75 millimeter gun, officers were accustomed to the one method of ranging, which gave a solution for all firing problems. When the new regulations came out, they distinguished two periods of fire. The first period was devoted to the determination and verification of the firing data, in adjustment or registration; the second was fire for effect, when the battery commander made use of the data so determined, in single shots, salvos, volleys or zone fire.

Many officers interpreted the new regulations in the light of the old. They considered that all shooting was still bullseye shooting; but that they had to choose between adjustment and registration in determining their data, and then among the four regulation methods in fire for effect. There were six methods instead of one, but that was all.

This was doubtless natural, but now that the properties of the new gun are better understood the idea is inadmissible. The working of the matériel is so flexible that the various methods of fire are susceptible of variation, and those given in the regulations are to be considered merely as normal types, intended to be adapted to circumstances. Everyone will admit this when he has taken part in such firing problems as we are about to consider, and has seen how each problem has its individual solution; but perhaps the point may be brought out here.

Every firing problem is made up of a number of circumstances, of which the principal ones are:—the intentions of the commander of the troops; the duty assigned the battery, which determines the effect its fire is to produce; the position of the guns; the preparation of fire; the nature of the target; the location of the target with respect to prominent landmarks; the effect of hostile fire upon the battery; the state of the atmosphere, etc. Each of these circumstances forms an item of the data for the problem, and each item has its influence upon the solution of the problem. A few examples will serve to illustrate this.

Let us consider three targets,—a wall, a line of artillery, and a line of skirmishers,—looking upon them, not as wooden figures, but as actual targets in war. Let us prepare to fire upon these three targets; upon the first, as if it were really a stone wall; upon the

second, as if it were a line of guns hidden behind a crest, only the flashes being visible; upon the third, as if it were actually composed of riflemen, hidden in the grass, so that the battery commander can see only a few of them, as they move or fire.

In the first case, the battery commander may perhaps adopt the standard method, firing first by salvo, then, when he has obtained a 50 meter bracket, continuing the adjustment by piece, and finally taking up fire for effect by piece, all with percussion fire. But circumstances might well compel him to take different measures; for instance, if there were a ravine in front of the wall and woods behind it, percussion shots would be lost, and it would be useless to try them.

Take now the second case. The enemy's guns are entirely invisible, so that he can not adjust by observing the bursts with reference to the target. To get the range approximately, he must fire upon conspicuous lines or points in front and rear of the target. Having thus gotten rough adjustment on these landmarks, he may try to reach the enemy by scattering shrapnel balls over the whole space where the enemy may be, that is, the whole zone of indecision of the target. We will discuss later on how this may all be done; for the moment, it is sufficient to point out that this firing has no resemblance whatever to that at the wall.

In the third case, the battery commander must proceed in still a different manner. He can not adjust upon the line of skirmishers itself, for the target is too mobile. All he can do is to adjust upon two lines or points, one in front and one in rear of the target, and then wait for a favorable moment to fire, as when the enemy's skirmishers move or fire, or when our own infantry advances.

These considerations show that the *nature of the target* affects the method of fire to such an extent that the battery commander has to act in three entirely different ways, to fire upon a wall, a battery, and a line of skirmishers.

Let us now go back to our second target, the artillery (Fig. A"). Call the target B, the battery firing upon it A, and our own infantry I. Assume B concealed behind a crest, but with less than flash defilade against A. A is in observation, with orders to fire upon any artillery appearing within a certain zone; unseen by A, B has taken position within this zone. B opens fire upon our infantry as it crosses the crest, surprising it and causing considerable

loss. It is the business of A to silence B as quickly as possible; the more quickly it acts, the less will be the losses of the infantry.

The solution is, to adjust rapidly upon the crest, to get the direction and height of burst, and a rough notion of the range; then open zone fire.

Now change the situation slightly. Assume that after completing its zone fire the battery A fires for registration, and finds that the ranges 2500, 2600 and 2700 cover the zone of indecision. The infantry I is crossing the crest in small parties, under the fire of B. A is ordered to fire upon B, to relieve the infantry. This may require it to remain in action for hours. It can not fire continuously, or its ammunition would soon be exhausted. Hence it fires only when where is a good opportunity,—when the infantry is about to be exposed, or when B fires. Whenever it does get the opportunity, it fires a salvo, using in turn the ranges 2500, 2600, 2700.

Now make another change in the situation. A mass of troops, infantry and artillery, is to cross the crest. A is ordered to keep down the fire of B, so that it can not fire a shot during all the time, several minutes, that the troops are passing through the area beaten by its fire. B must be kept continuously under fire; this means that there must be a constant rain of bullets over the whole zone of indecision. To get this result, A must fire with all three ranges,—2500, 2600, 2700,—at once. We shall see later on how this is done.

These examples show how a battery, without changing position or target, has to change its method of fire as conditions change. In these different situations, the battery has had occasion to fire in three different ways. First, it made a rapid adjustment and then took up zone fire with an initial range of 2400 meters. Next it fired consecutive salvos at 2500, 2600 and 2700 meters. Finally, it passed to continuous fire at three ranges. It is evidence, then, that the *tactical situation* influences the method of fire.

We shall see later on to what extent this is true. But we are now in a position to say that, the more one works over varied ground with the 75 millimeter gun, the more clearly he sees that its flexibility is such that its methods of fire may be varied without limit, and a suitable solution given to every possible firing problem. This is what we mean when we say that every individual problem has its own individual solution.

It is to be presumed that, on the battlefield, the tactical situation will be the thing that principally holds the attention of all officers. Properly instructed artillerists will, therefore, naturally fit their solutions to the problems as they arise. But if officers are not properly prepared, if they are not fully conversant with the properties of their matériel, if they have to try experiments in the face of the enemy, then it is certain that they will not find the proper solutions for their problems, and that they will be found incompetent. Officers should, in time of peace, study great numbers of concrete cases, so that they can solve such problems as may arise without hesitation. If they can not do this, they can not hope that, in the face of the enemy, they will hit instinctively upon the correct solution for every problem they encounter.

LECTURE NO. 2.

We can doubtless now assume as an accepted doctrine that every concrete case is a separate problem of fire, and has its own individual solution. But this should not lead us to conclude that battery commanders will find it exceedingly difficult to hit upon the true solution for each problem. Since the adoption of the 75 millimeter gun, methods of fire have changed, but they are not necessarily more difficult than they were with the 90 millimeter; officers have simply had to get into new habits.

The new gun is much more powerful than the old; but to get the advantage of its power one must know how to utilize not only its rapidity of fire, but its adaptability. The fire ought to be perfectly fitted to the target; and this desideratum can be attained, evidently, only by officers and men thoroughly trained in work with the matériel over varied ground. It must be admitted that there are still many officers, excellent in handling the old guns, who do not appreciate the new one; but the number who are behind the times is rapidly diminishing. An officer who uses the new gun merely as a more or less improved type of the old, may be compared to one who has for years ridden an awkward, ill-trained horse, and who is just beginning to appreciate the merits of a finely-trained thoroughbred, but does not yet know how to use him.

With the 75 millimeter gun, within a few seconds after a projectile bursts, we can fire another, any given distance to the right or left, over or short, higher or lower. Merely announcing a number

will do this, for when the fire is once prepared the process of aiming is entirely independent of the target. None of the cannoneers need even know what the target is; even the gunner has only to keep his sight on the aiming point. The captain places his projectiles almost as if he were doing it by hand. Adjustment and registration are very rapid. The only difficulty is in the observation of fire, and this is greatly facilitated by the dense smoke of the service projectiles.

With this gun, a target of any form or location may be effectively attacked. If it is a long thin line, the battery commander distributes his projectiles in breadth; if a narrow column, in depth; if a rectangle, having considerable depth and breadth, he does both. If the target occupies an indefinite position, within a certain area, he distributes over the whole area, so as to be sure that some of his shots reach it. In every case he adapts his fire to the target.

Again, the maximum rate of fire being great, the actual rate may be varied indefinitely, and the density of fire proportioned to the requirements of the case.

All this goes to show that it takes considerable skill to handle the 75 millimeter gun. A captain can not handle a battery properly without having served an apprenticeship. The time required is considerable at present, but it is only fair to believe that it will gradually diminish, as was the case when the 90 millimeter gun was first introduced. The reason it takes so long now to train an officer in the conduct of fire is that the instructors have to fight against old habits. Building up the proper new ones should not in itself be so difficult, for the solution of a firing problem is merely the application of certain simple and familiar methods to a concrete case. When a captain has had a certain amount of practice, his ordinary common sense will help him to solve his problems.

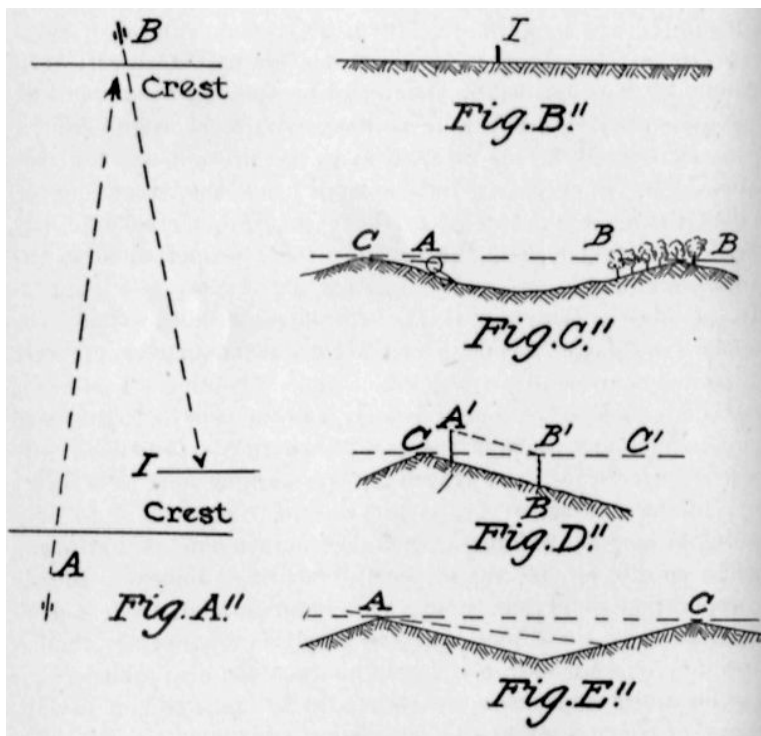
In this series of lectures, an effort will be made to simplify the solution of firing problems by separating them into several parts. Every problem has three parts. The first is the preparation of fire, which consists in determining the firing data (deflection, deflection difference, angle of site, corrector, range), and preparing the guns to fire. The second is fire for adjustment, to verify and correct the data. The third is fire for effect. We will examine each of these parts separately.

Preparation of fire.—This may again be subdivided into the *determination* and *application* of the data. Under each of these

heads there are several operations, distinct but overlapping. Let us examine these operations.

The determination of the firing data is a purely technical matter, which is fully discussed in the regulations, so that it need not be gone into here. The application of the data depends more or less upon the tactical situation, and numerous questions arise.

If fire is to be opened at once, the captain may decide to use direct laying; or elevation may be given by the quadrant and



direction by the sight, each piece taking a separate point of the target; a common aiming point may be used; the sheaf may be formed by reference to a registration point, or the pieces may lay upon each other's sights; the distribution difference to be used has to be determined. If the battery is taking position in observation, he must consider whether or not the guns are to be anchored; if they are not anchored when they first take position, he may or may not wish to do so before opening fire; if they are anchored at the outset, he must decide how to form the sheaf,—whether with a small

distribution difference upon the center of the sector of observation, or with a large distribution so that each piece covers a quarter of the whole sector. All these questions will be taken up later.

Fire for adjustment or registration.—Assume that, in directing service practice, an officer assigns as a target to one of his batteries a line of infantry I (Fig. B") crossing open ground, and to another a battery A (Fig. C"), concealed behind a crest C, its flashes being visible behind the crest and in front of the woods B. These are both simply technical problems; the tactical situation is not considered.

Each captain, then, is called upon to make his preparation of fire, determining the initial firing data, and then adjust, finding his bracket and verifying his deflections and corrector. The solution is purely technical. Fire for effect can not be thought of; for the captains do not know the military situation, and have no means of determining what effect they ought to try to get. The solution of the first problem is preparation of fire, followed by adjustment upon the infantry; of the second, preparation of fire and two adjustments, one upon the crest C and the other upon the woods B.

Suppose now that, besides designating the targets, the officer directing the practice also gives out tactical situations. The solution of the problems will be the same, in the sense that the two battery commanders will have to make the same adjustments of fire as before; the manner of getting these adjustments will vary with the tactical situation.

In the case of the infantry target, the adjustment may be considered complete when the 400 meter bracket is obtained, if the captain thinks that his target may disappear, or that the enemy's artillery may fire upon him, or if for any other reason he thinks it necessary to commence fire for effect as soon as possible. Or, it may be continued until a fifty meter bracket is found, if saving ammunition is more important than saving time.

In the case of the artillery, if the situation requires fire for effect as soon as possible, adjustment may be made upon the crest and zone fire taken up at once. If more time is available, both adjustments should be made, one upon the crest and one upon the woods. Both adjustments may be by battery salvos, or one by salvo and the other by piece, or both may be by piece and the distribution and corrector may be determined by a salvo or two afterward. Either one of the two adjustments may be made first.

These examples show that every situation devised by the officer directing the practice constitutes a separate problem in fire for adjustment, and has its own individual solution, consisting of the adaptation of some technical procedure to the tactical situation. We may generalize this conclusion by saying that to find the correct solution of a firing problem we must first choose a technical solution adapted to the target, independently of tactical considerations, and then adapt that solution to the actual conditions.

The technical solutions are few in number, and officers can easily learn what they are. When an officer has learned to choose the proper technical procedure without hesitation, he will have no difficulty in applying it to the concrete case. Grouping all possible cases of fire for adjustment which may have the same technical solution, we may make the following classification:

A.—The bursts can be observed with reference to the target.

B.—The bursts can not be observed with reference to the target, but can with reference to (1) cover near the target; (2) two landmarks, one in front and one in rear of the target; (3) cover on the sky-line, masking the target.

C.—The target is not in sight, but is expected to appear (1) near some landmark; (2) between two landmarks; (3) behind cover on the sky-line; (4) in a certain area.

In each of these classes there are various forms of target, but the same procedure applies in adjusting upon any of the class. Let us now see what these solutions should be.

A.—Examples of this class are:—the edges of villages or woods, walls, hedges, houses, artillery in open positions, troops of any arm far enough from cover so that they can not get out of sight quickly, No mention is here made of moving targets, for they no longer constitute a special class. On the battlefield, the great majority of them are moving perpendicularly to the front of the battery; and their rate of movement is insignificant for a battery which can change range 1,000 meters at a time, as fast as the captain can speak the numbers.

For this class, the solution of the problem is to determine the initial firing data and then adjust upon the target itself. This is the technical solution; the captain adapts his form of adjustment to the tactical situation. He may fire salvos, so as to get deflection, deflection difference, corrector and bracket all at once; or get the

bracket by single shots, and the rest of the data by one or two special salvos. He may be satisfied with a 400 meter bracket, or narrow it to 200, 100, 50 or even 25 meters.

B (1).—Examples:—troops under cover, or observed entering cover. The adjustment is made upon the cover as if it were the target.

B (2).—Examples:—infantry or artillery observed disappearing between two lines of cover; artillery revealed by flashes between two landmarks; skirmishers moving through high grain, which conceals the men. The solution is to range upon the two landmarks, thus determining the zone of indecision.

B (3).—Examples:—troops just disappearing behind cover, as infantry after a rush to the front; artillery seen going into position, or in position and revealed by flashes on the sky-line. The adjustment is on the mask, giving the deflection, distribution and corrector, and the short limit of the zone of indecision. The long limit is found by firing for registration on the ground behind the mask.

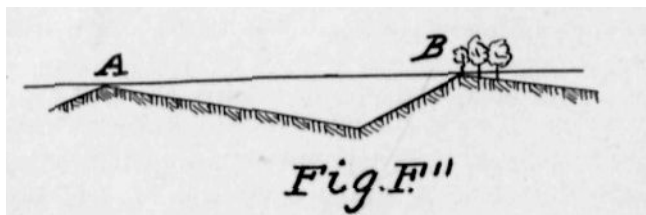
The method of registration depends upon the fact that the ball of smoke from a shrapnel burst has a diameter about equal to the length of the gun flash, say three meters. In Fig. D", let C be the crest on the sky-line, CC' the line of sight from the observer, A the target (artillery revealed only by flashes), AA' the height of the flashes. Fire percussion shrapnel behind the crest, increasing the range by 100 meter steps, until the smoke can no longer be seen. Let B be the point of burst at the final range; BB' will be equal to AA', and B is certainly long with respect to A.

This fire should be so conducted as to trace a complete profile of the ground. It should be done with one gun, all shots exactly in the same line, so that no visible shot can be overlooked. The battery commander gets a shot squarely on the crest, and then notes how the smoke of succeeding ones sinks lower and lower, so getting a good idea of the shape of the ground behind. Any doubtful shot should be repeated until the doubt is cleared up; and important ones should be repeated in any case, to eliminate the effect of inaccuracies in gun or ammunition.

Two remarks are to be made on this kind of fire. First, it can be done only with service shrapnel, not with practice projectiles, which give a smaller and thinner smoke ball; secondly, observation must be instantaneous, before the smoke has a chance to dissipate; the wind sometimes carries it to a height of as much as ten meters.

C (1).—Here the captain has to make his adjustment or registration

beforehand, so as to be ready to take up fire for effect the instant the target appears. The following examples illustrate the process:



The battery commander is behind crest A (Fig. E"); he can see crest C, and a very little of the ground in front of it. His probable targets are infantry crossing crest C to reinforce a skirmish line in the low ground, and artillery taking position on the crest. Or, the battery commander behind crest A (Fig. F") can see the edge of the woods B, the range to which he has found. He may have occasion to fire upon infantry coming out of the woods, or artillery taking position in the edge. Or, having ranged upon any piece of cover,—crest, hedge, woods, wall, etc.,—he may have to fire upon a skirmish line observed entering or leaving the cover, or upon artillery behind the cover, revealed by its gun flashes or by movements of teams.

To be ready to fire upon any of these targets instantly, the captain must have adjusted beforehand upon the landmark near which they appear. The situation is similar to that discussed under B (1), the only difference being that in that case the fire for effect immediately followed the adjustment, while here there may be a long interval between them. The instant the target appears the captain gives the necessary firing data and opens fire for effect.

C (2).—The target is looked for between two landmarks. Examples of this are:—infantry observed crossing a crest and disappearing behind woods; artillery exposing itself for a few seconds while limbering or unlimbering between two hedges; a skirmish line moving through high standing grain, between two open fields.

When such a target is discovered, the captain must be ready to fire upon it instantly. After determining his initial data, he adjusts upon each of his marks, so as to get the approximate limits of the zone of indecision and verify his data. This case is like

B (2), except that some time elapses between the adjustment and the fire for effect.

C (3).—The target is looked for behind some object on the sky-line. Examples:—infantry falling back over the crest; artillery observed limbering or unlimbering; artillery revealed by flashes on the sky-line. The case is like B (3) except that the adjustment and registration are made at leisure, and the fire for effect comes much later.

C (4).—The target is expected within a certain area. Examples:—skirmishers advancing in lines or groups from cover to cover.

Here the fire for adjustment or registration is for the purpose of enabling the battery to open fire upon the target the moment it appears, while it is vulnerable. When the area to be registered is large, the captain needs some experience and skill to conduct such fire properly, for without it the ammunition expenditure may be out of all proportion to the object in view. We will devote a special lecture to this fire upon a registered zone.

Conclusions.—In this lecture we have examined the method of determining what firing data should be used in the various cases that may arise in action. The method consists in various kinds of fire for adjustment or registration; we have determined upon various technical solutions, corresponding to the various firing problems, as follows:

A.—Adjustment upon the target.

B (1) and C (1).—Adjustment upon some object near which the target is observed or expected.

B (2) and C (2).—Adjustment upon two objects, bracketing the actual or anticipated position of the target.

B (3) and C (3).—Adjustment upon the sky-line in front of the target, and registration of the ground beyond.

C (4).—Adjustment and registration for the purpose of determining approximate firing data for targets that may appear anywhere within a given area. The methods of conducting this fire will be taken up later.

We have seen that, to find the proper firing data in any particular case, one of these technical methods is selected and then adapted to the special conditions. The selection will not be an easy matter; the only difficulty remaining is to make the proper adaptation, and this is not so difficult as it might appear. If an officer has been properly trained in the study of firing problems, he may expect to

be able to adapt his firing to the tactical situation instinctively when it comes to actual war.

From all the foregoing discussion we may draw two conclusions.

1.—Only one of the solutions, which we have called class A, consists in adjustment upon the target. In all the others, this is out of the question, and the firing is upon points or lines in the terrain. Adjustment upon the target, then, is only one of the problems that we shall have to solve in war, and perhaps the easiest of them all. And since, judging from the events of the last war, it will also be the least common, it follows that in service practice *adjustment upon landmarks should be the rule, and upon targets the exception*. Officers must accustom themselves to this idea,—that they may go through days at a time in service practice, without seeing a single adjustment upon a target. We insist upon this point, because there are still many artillerymen who, for whole seasons, continue to adjust upon wooden targets, just as they used to do.

The principal use of the targets set up at service practice is in fire for effect, executed at short notice by batteries which have fired for adjustment upon some landmark. To save ammunition, such fire is simulated; the captains give the commands, but the cannoneers are notified not to use ammunition. After the simulated firing, a few shots are fired to determine whether or not the fire would have been effective.

2.—Since adjustment upon the target is exceptional, adjustment by battery salvos should also be exceptional. This is unquestionably the best method of adjustment upon a target, for it will probably give some effect at the same time; but it is not justifiable otherwise. One or two salvos will give the direction, distribution and corrector; after that, it is sheer waste of ammunition to fire salvos to get the range to lines or points on the ground. Fire by piece will give the range more accurately and economically.

LECTURE NO. 3.

Fire for Effect.

A battery commander requires some experience to find the correct solutions for all his firing problems. For those who lack practice, and who do not readily see the solution, the best procedure is to

divide the problem into its parts. Although the solution of each partial problem is an integral part of the final complete solution, still this course reduces the difficulties.

Artillery acts by fire only; that is to say, by fire for effect, for the effect produced by fire for adjustment is merely incidental, and entirely uncertain. The final solution, then, of any firing problem, is the delivery of fire for effect, suited to the particular case; how can this adaptation of means to end be made?

For the artillery officer, the first thing to do is to decide precisely what effect is required. This is the first partial problem. Shall it be *demolition*, as in the case of breaching a wall or fire upon visible artillery? *Destruction* of infantry crossing an open space, or artillery coming into action? *Neutralization* of infantry in trenches or artillery behind a crest, by continuous fire? Or combined *destruction* and *neutralization*, by firing upon troops under cover, either infantry or artillery, whenever they open fire?

When the captain has decided what effect he wants to get, he must think what means to use. He already has the necessary firing data; how is he to use them? Shall he use shell or shrapnel? If shrapnel, shall the fire be time or percussion? For demolition, how many rounds will he need? For destruction, how shall he distribute the fire? What shall be the density? How deep a zone shall be cover? What kind of fire shall be used? For neutralization, what shall be the rate of fire? For combined destruction and neutralization, what projectile, rate and kind of fire shall be used? In a word, the second partial problem is, what kind of fire for effect is adapted to the conditions?

When all this has been decided, one question still remains. The third and last partial problem is, when shall the fire for effect commence?

To sum up, in every case the battery commander must ask himself three questions:—what effect is to be produced, what kind of fire shall be used, and when shall that fire commence?

But the answers to all these questions depend upon each other and upon the methods adopted for preparation of fire and adjustment. No one of them can be answered without reference to the rest. In solving any particular firing problem, the battery commander must have in mind all the time all these questions. But before he can intelligently answer any questions as to fire for effect, he must be familiar with the effect of fire and the use of the

various methods of fire. This knowledge is important, for it is the foundation of our whole discussion; and observation of service practice seems to indicate that our officers do not all possess it.

Effect of Fire.

The 75 millimeter gun fires two projectiles, shell and shrapnel. We will take up shrapnel fire first.

Shrapnel is used for both time and percussion fire. In time fire its bullets are distributed over an area about 25 meters wide and 100 long.¹ It is also used as an incendiary projectile.

Before giving the figures by which the effects of shrapnel fire are expressed, it will be best to show how these figures are obtained. A board appointed for the purpose conducted a long series of experimental firings, on the following plan.

1.—Effect obtained while adjusting is always eliminated. Such effect is found to be so variable that no general conclusions can be drawn from it.

2.—The destructive effect upon troops is expressed in per cent of losses inflicted; that is, by the number indicating the number of men per hundred put out of action.

3.—The silhouettes used as targets are graduated in thickness, so that bullets striking any part of them will not penetrate unless the remaining velocity is sufficient to inflict a mortal wound.

4.—Fire for destruction is always executed with a fixed density. This is necessary to permit comparison of effect obtained upon troops under varying degrees of cover. Density 8 is usually selected, corresponding to 8 projectiles upon a front of 100 meters, or 4 upon 50 meters. Knowing the percentages obtained with density 8, the effect with different densities may be computed; and, conversely, the percentage for density 8 may be computed from that obtained with any other density. Thus if fire with density 8 gives 10 per cent, density 16 will give 10 per cent, plus 10 per cent of 90, or 19 per cent; density 24 will give 10 per cent, plus 10 per cent of 90, plus 10 per cent of 81, or 27 per cent in all.

All the figures that follow are obtained by taking the mean of several experiments; they are for a range of 2,500 meters.

Demolition.—Wall: 50 rounds for a 25 meter breach.

¹ These and all similar figures are not official, but merely convenient approximations.

Artillery matériel: 50 rounds to destroy 6 caisson bodies.

Earth: effect very slight.

Destruction.—The following table shows results obtained with densities of 4, 8, 16 and 32. Where the figures were not obtained by actual firing, they were computed by the formula:

$$\text{percentage} = 100 \left[\frac{n}{d} \right]$$

in which n is the percentage obtained by fire with density 8, and d the density assumed in the calculation:

?? Density of fire.	4	8	16	32
	%	%	%	%
Skirmishers, standing, without cover.....	25	40	65	--
Infantry in column, standing, no cover	15	25	40	65
Skirmishers, lying down with knapsack on back; artillery in action, men behind French regulation shields	7.5	15	25	40
Skirmishers lying down, knapsacks in front of heads; artillery in position, men taking cover behind French regulation shields	--	7.5	15	25
Infantry well entrenched and not firing; artillery in position, men taking cover behind French regulation shields, space below shields closed	-	2 or less		--

Neutralization.—The rate of fire for neutralization may be varied indefinitely. One round per minute on every 25 meters front may be taken as a fair average, to be increased or diminished according to the importance and difficulty of the case.

Shell is used only in percussion fire. As distinguished from shrapnel, its effect is chiefly lateral, covering roughly 25 meters in depth and 50 in breadth. Its burst is harder to observe than that of shrapnel, and hence it is chiefly used against, objects of considerable size where observation is easy.

Demolition.—The demolition effect of shell is similar to that of shrapnel, upon walls, etc.; it is much superior against buildings, artillery matériel, etc., when the bursts can be clearly observed.

Destruction.—Since shell fragments scatter over a broad but shallow area, this projectile is not suitable for this kind of fire,

which is usually executed by volleys at an approximate range. There is, however, one case where it is to be recommended,—to reach infantry behind a wall; here it bursts as it passes through the wall, and reaches the men close behind on both sides.

Neutralization.—Shell may be preferable to shrapnel in fire for neutralization, where the range is known within 25 meters. In this particular case its greater explosive force and its broader distribution reduces the necessary expenditure of ammunition by half.

Conclusions.

From the above data, we may draw the following conclusions for shrapnel fire; they are also applicable to shell fire, subject to the restrictions indicated above.

Against infantry standing, without cover, a density of 8 will always be sufficient; anything more is waste of ammunition. At service practice we often see a volley of say eight rounds fired at such a target on a front of 50 or even 25 meters; this means a density of 16 or 32. If the fire is properly adjusted, density 8 is sufficient; if not, increasing the density will not give effect.

Against troops under good cover, the effect is so much reduced that artillery should fire for neutralization rather than for destruction. The batteries take position in observation, and fire whenever the target exposes itself; against infantry, when it leaves cover, and against artillery when it fires. According to circumstances, firing may cease altogether between these opportunities (intermittent neutralization), or it may continue more slowly (continuous neutralization).

The density of fire for neutralization is always great. Thus, a battery firing upon a front of 100 meters, at the rate of one round per gun per minute, will give a density of 20 for every five minutes it remains in action. This fire is most effective when it can be so timed as to have the projectiles burst at the precise moment when the enemy exposes himself.

Fire of a given density upon troops in *line* and in *column* gives the following results:

Density 4, percentage 25 in line, 15 in column.

Density 8, percentage 40 in line, 20 in column.

Density 16, percentage 65 in line, 40 in column.

This shows that troops surprised by the fire of artillery are less vulnerable when in column than when in line; this is because the men in front protect those in rear. The point is worth remembering, but it has no real significance unless the infantry can be concealed from the artillery. The mechanism of fire is flexible enough to permit the artillery to turn its fire instantly upon any desired point in a registered area, and reach a target covering a broad shallow space, or a narrow deep one, or any irregular formation, such as skirmishers scattered over the ground in small groups. After the area has been registered, a battery may deliver at any desired place a veritable rain of bullets, comparable to actual rain driven by a strong wind. Just as there is no formation that will keep troops from getting wet, so there is none that will protect them from the fire. By closing up tightly the men give each other a little protection; but this does no good if they are visible, for the artillery can then increase its density of fire in the same proportion as the density of the target increases.

So, then, in discussing the subject of formations for infantry under artillery fire, it is necessary to distinguish two cases. If it is invisible from the artillery observing station, it should preferably move in column. If it can not find concealment, it makes little difference what formation it takes, since an artilleryman who knows how to handle his fire can get the same effect in any case; the formation must be decided by other considerations than that of vulnerability,—the haste necessary in the particular case, the form of the ground, the degree of visibility, protection given by friendly batteries, etc.

[TO BE CONTINUED]

NOTES ON THE GERMAN MANEUVERS.

BY CAPTAIN ERNEST D. SCOTT, 6TH FIELD ARTILLERY.

PUBLISHED BY PERMISSION OF THE WAR DEPARTMENT.

Last September I was enabled, through the good will of the American attaché at Berlin, and the kindness of the German War Office, to attend a series of brigade, division and corps maneuvers. Many other American officers have gone over to German maneuvers, but always to the Imperial or some corps maneuvers; I believe I am the first to attend a complete series, probably for the reason that it is not generally known that permission can readily be obtained. Many German officers mentioned the fact that officers from every country but the United States attend, and asked why it was.

No officer need feel the slightest hesitation about asking to attend such maneuvers if he is going abroad. The German War Office is very liberal, five dollars a day is the most that a horse will cost, and other expenses are no more than ordinary. I had been led to believe that the expense would be great, that the officer in charge of observers would make it his business to see that they saw nothing, that I should not be permitted to hear critiques, and so on. Nothing could have been farther from the reality. We were given every courtesy, made members of a regimental mess, furnished with maps, situations and orders, kept informed of all that went on, not permitted to miss anything social or official, were present at all critiques, and always there were officers, some English-speaking and some not, who would inquire if we had understood, and volunteer explanations. Without being a nuisance, more could not have been done. You know how in field service when the weather is good, surroundings pleasant, and troops from different stations come together, what an air of good-fellowship there is. It was just so over there; they took us in as comrades, and I believe when we separated the regret was mutual.

Each year, each corps has its maneuvers. They are held in September, because then the weather is best, the crops are off, the men finishing service are in their last month. These maneuvers are the

completion of a year's progressive instruction that began with the arrival of the recruit class in the preceding October. They consist of brigade, division and corps maneuvers. In the area assigned to it, each brigade of infantry, with a regiment of artillery and some cavalry attached, has its maneuvers under its own chief. The latter splits his force up and pits the two parts against each other; he is the critic. After three or four days of this his force as a whole is pitted against the other half of the division, and the division commander is the critic. After some days of this, the division marches against the other division of the corps, and after two or three days' operations the two unite and attack a marked enemy. The corps commander is the critic. This concludes the maneuvers.

In alternate years Imperial Maneuvers are held. The Kaiser designates the corps that are to participate, visits each and reviews it. These reviews are called "Kaiser Parades," and are full dress affairs. After he has finished with each corps it proceeds with its own maneuvers as above described, and when these are finished the Imperial Maneuvers take place, one or two corps operating against another. These are necessarily over a large area, but last only two or three days; the invitations are entirely in the Kaiser's hands.

The last week of August I was in Stettin, the guest of a relative, Lieutenant Colonel Roessler, of the 34th Infantry, through whom I saw something of the German army at home, and held places of vantage at the spectacles. While here I received notification that I would be permitted to attend the maneuvers of the XI Corps, September 7-20, and should present myself on the former date to the commander of the 71st Infantry Brigade at Nordhausen.

September 7th was devoted to getting settled in quarters, etc. The 71st Infantry and two squadrons of cavalry were quartered in Nordhausen, a battalion of the 19th Field Artillery in a village near by. Outposts were established about two miles west at 6 a. m. on the 8th. Cavalry patrols could cross this line at 5 a. m.; closed bodies not before 8 a. m.

The Reds, 95th Infantry, 11th Jäger Battalion, one battalion 19th Field Artillery and three squadrons of cavalry, were about fifteen miles west, with similar instructions as to outposts and patrols.

Red was ordered to break the railroad near Nordhausen. Blue was ordered to cover it, and to this end moved out to the west at 7

a. m. At 10 a. m. contact was made, and by noon the opposing parties were about 1,000 yards apart. Neither side had any advantage that was not offset by something on the other, and only bullets could have decided. At 1 p. m. all officers were assembled between the lines, and the brigade commander discussed the whole affair. I want to say right here that the German general is a wonder at this. Without reference to a note or asking questions, he will state the general and special situations, where each side was quartered, what the lines of outposts were, the strength of the parts of the outpost, the disposition of each, criticize the same, state what information was brought in by the patrols and when, criticize the action taken thereon, state the formation of the respective advance guards and criticize their conduct; in brief, relate and comment upon every detail of the work on both sides up to the time he ordered the halt sounded. Sometimes he talks an hour or more. It is amazing.

In this case he decided that Blue should retire, which it did, settling in bivouac for the night about six miles from the battlefield. During the night it lost touch with Red, and in the early morning got the idea that the latter was marching around the left flank. A poor piece of work occurred here. Instead of marching toward their left flank and pushing out an advance guard from the main body, the outposts were ordered to the left to form an advance guard. Now the Reds were actually where they had spent the night, and had their commander not been very slow to start he would have struck the Blues strung out in column a mile and a half long across his front.

The commander of the Blue outpost had not been satisfied with his superior's estimate and decision, and had hardly gotten his advance guard formed when he threw out part of it as a flank guard well to the right; this discovered the Reds in time to seize and hold a strong position, while the Blue artillery went rapidly to its assistance. Red was again slow, and got most of his force in position before attacking; meanwhile the Blue infantry came up, and a decision in their favor resulted. The Blue cavalry had gone off to the south, and I don't know when they returned.

After the critique Red was ordered to retire, Blue to follow with fire only. Back of Red stretched a saucer-like depression perhaps a mile and a half across by a mile wide; there was practically no cover. The whole force drew off in successive lines of skirmishers at about five-yard intervals and marched steadily along, and could

be seen closing into platoon columns as they went over the farther edge of the basin. Little attempt was made at returning the Blue fire. The Red artillery retired by battery, two going first to a little rise in the side of the basin, and later joining the third, which first fired from the shelter of a village, and when the two opened from the position on the rise trotted off to a defiladed position beyond the farther rim of the basin. It was all very pretty, but it looked like slaughter for the Reds.

The 10th was Sunday. On the 11th Blue assembled south of Nordhausen, and there entered upon another problem that resulted in a lengthy affair six miles west from the assembly point. This ended the brigade maneuvers, and the whole force marched to Sondershausen, twelve miles, and went into quarters.

Next day the brigade moved south, and about six miles from the starting point struck the other half of the division. A very extended affair resulted in the defeat of the latter, who retired south out of reach, and scattered along a front of five or six miles. Toward morning they assembled to their right, moved back to the attack, turned the Blue left and won an unquestioned victory. Blue retired eight miles to Sondershausen.

Next day was a rest day. Sondershausen is in a valley, on the north side of a heavy forest from one to three miles wide and ten long. To cover certain roads through this, Blue went up through it, but Red was energetic, marched ten miles, and attacked the Blue heads of column as they came out of the defiles, about five miles from where they started. Blue retired toward Nordhausen, twelve miles distant; the Blue artillery did some beautiful work in covering the retreat. In this affair occurred a cavalry attack upon two Blue batteries, and earlier in the day a futile attempt of Blue cavalry to surprise Red from the wood.

That night Blue entrenched on high ground two miles west of Nordhausen. Red came up during the night, kept up a steady artillery fire at 3,000 yards all night long, and just at daylight launched an attack that carried all before it. The Blue disposition was faulty. A deep and wide ravine, open toward the enemy, cut the position in two; the slopes toward the enemy were convex, and he got up within a hundred yards of the trenches on part of the front without molestation. Half the Blue artillery was in the infantry line, and was lost with only time for a shot or two.

A day of rest came, and then the united division, taking road spaces as if at war strength, started to seek the other division, which had been having its brigade and division maneuvers about Mülhausen, thirty miles southwest. It is quite a problem to ride from the tail to the head of a division on the march; we started at 7 a. m., and reached the head of the main body at 10. It would have taken longer, but disquieting news had been received, and the main body was closing in mass at Erdeleben. The 71st Brigade marched the first twelve miles that day without a halt. A drawn battle ensued that afternoon, and at its conclusion Blue, at least half of whom had marched thirty miles, was ordered to bivouacs and quarters five miles from the battlefield. That evening I saw the only straggling, and there was little of it. It was a cold, raw day, good for marching but not for bivouacking; but my old friends of the 71st, officers and men, sat up around fires until very late, drinking a little red wine and singing songs. They are certainly a sturdy, cheerful lot.

Next morning the division again moved southwest in two columns. The enemy was found entrenching about three miles from the scene of the previous day's engagement. We learned the Blue plans and watched their initial development, and then rode to the Red side, looked over their dispositions, and watched the Blue attack.

Red had a front about two miles long, and massed his reserve at his right. Blue advanced on a curve about three miles long, his main attack being on his right. Red did not discover this, and while he was preparing a counter attack on his right the Blue right swept over his left, captured half his artillery, and made his position untenable. Blue's left, elated at the success on the right, was pushing on with little regard to its exposed flank, when the Red cavalry division appeared. It seemed the moment,—a better could never be found,—when the cavalry should stake all on a single throw and go in boot to boot, but it didn't. It dismounted to fight on foot, and before it could make its advance felt the corps commander decided that the rout had gone far enough and the halt was sounded. The whole corps scattered about the country within a radius of five or six miles.

Next day they advanced in two columns to attack a marked position supposedly held by a Red division, fifteen miles northwest of the scene of yesterday's struggle. The Red front was about three

miles in extent; single guns represented batteries, squads represented companies. All were well entrenched. Most of the artillery was in the infantry line and fell with it. All of it could have found excellent positions in rear of the line, within a mile, where it could have supported the defense until the last, covered the withdrawal and gotten away itself. The whole position seemed to have been taken up with a "last ditch" idea. That is all right, but even if one does intend a finish fight one should at least make it as nasty as possible for the enemy. It was the old mistake of no depth.

Blue deployed over a front of nearly five miles. The English cavalry colonel who was with us afterwards asked what I thought of their extensions. I replied that it was a revelation to me, something quite at variance with their teachings. He said, "they sneered at ours in South Africa, and I will admit they were rather excessive; but they are not sneering at what went in Manchuria."

By 2 p. m. it was over. Columns were stretching out over the roads in all directions toward their entraining points, the men singing; the one authorized photographer, only allowed on the field this last day, was taking pictures, regimental groups, staff groups, observers, etc.; officers were bidding each other good bye for another year; the crowds of people of both sexes and all ages were tramping homeward. We rode back to Mülhausen. Our adjutant, as he styled himself, had ridden twenty miles that day, and announced his intention of riding home to Erfurt, forty-five miles farther.

VISIT TO QUARTERS OF PART OF THE XII ARMY CORPS AT DRESDEN.

This visit was arranged for by the German War Office at the request of Captain Shartle, our military attaché. A major of the Grenadier regiment was detailed to escort us, and we went first to the barracks of the machine gun company belonging to the regiment.

The barrack is about ten years old, but is one of the most up-to-date in the German service. It took but a few minutes to decide that in every respect the building itself is inferior to ours. Means of ventilation were limited to doors and windows; a few of the latter had transoms, but none of the former. Shafts there were none. The bunks were wooden, with straw-filled ticks. All the sleeping rooms were much overcrowded, but it is to be noted that they are used only as sleeping rooms, other rooms provided with

lockers serving as dressing and living rooms. In this and other barracks it was curious to note that the first sergeant, when married—and he usually is—lived with his family in the barracks. A very few of the sergeants have rooms separate from the men.

The wash rooms have something worth copying. Along the sides are iron troughs, half cylinder in form, about sixteen inches in diameter; crosspieces at intervals of about sixteen inches bear at their centers trunnion beds. In each of the squares so formed is a washbowl, about fourteen inches square, a section of a half cylinder, its axis coincident with that of the trough, and suspended by trunnions on the crosspieces. The bowls are of iron, porcelain covered. A pipe, with spigot for each bowl, runs along the wall. One lifts the basin by the near side and its contents are dumped into the trough, whence they flow into the drain. The system is simple, cleanly, and fool-proof, which ours is not. The annual repairs on the lavatory of one of our barracks would pay for the installation of one of these German sets, and it is difficult to see how repairs would ever be needed.

The stables were next visited. They are much on the order of our single-gangway cavalry stables, but are divided into sections, each accommodating about twenty animals. All animals were inside; there are no picket lines, but grooming is sometimes done outside, the horses being tied to rings on the stable walls. All horses were well groomed. Blemishes and defects were frequent; a bad weaver was noticed in three different stables. I think there is no question that the German, by care and attention on the part of the personnel, reduces expense and raises the figure of efficiency. I doubt if "stables," as we know it, obtains with them. Certain it is that a horse and every bit of his equipment is put in first class condition *immediately* upon return from any duty. Bedding was abundant. Instead of partitions, swinging bars separated the horses in all stables, and each had a heavy straw mat suspended from the rear third of it. Judging from their condition, kickers are not uncommon. In one stable beautifully braided straw mats forty feet long and two feet wide had been laid down over the gutters. The stables and gun shed of a light artillery regiment and the stables of a squadron of cavalry were found to be much like those of the machine gun company.

In point of cleanliness, good order, care of stock and material, the stables are as much in advance of ours as our barracks and care of personnel are ahead of theirs.

The artillery saddlers were all in one shop, the horseshoers in another, etc. This is exactly right; men learn from each other, and officers can make comparative examination of work and methods. Our service should adopt this. The artillery was also equipped with a complete machine shop with electric power; it must be invaluable.

The whole regiment occupies less ground than one of our battalions. The course of our posts is the way they are spread out, but advocates of the quadrangular system should consider that the Germans themselves are departing from it in all new construction, and following American, or rather modern, lines; that summer heat such as is common in America is unknown there; that flies in most parts of the country are few in number; and that the annual range of temperature is comparatively small,—all conditions that tend to make narrow quarters comfortable.

The last visit was to a company storeroom, which contained the complete field dress and equipment of the company for war strength. The whole army is said to have the new grey uniform in stock, but is wearing out the old. Certainly this company outfit was complete. One hussar regiment of the XI Corps, organized since the new uniform was adopted, was equipped with it alone, and enjoys the distinction of having no other. Needless to say, as a gala dress it is much better than our service uniform would be.

My American *compadre* on maneuvers wore a new service blouse with patch pockets; mine had bellows pockets. The Germans are quick to notice differences and ask about them, and one and all expressed wonder that such a change should have been made.

From Dresden we went to Königsbrück, about twenty miles away, where the commandant, a major general of infantry, and his adjutant, a captain of field artillery, showed us over the place. It is a triangular area about five miles on a side. Barracks and quarters for the permanent garrison are tucked away in one corner; these are very like American. Long, low, one-story buildings furnished quarters for student officers and troops sent for instruction. Observation stations, banked with earth, with low armored towers on top, are scattered about. All are connected with each other and with the power plant and headquarters by telephones, whose wires are underground. Signal towers with four-foot balls of basket work threaded on pipe, painted red or white, are also used. In one corner is the power house, containing equipment for operating targets

by electric power. Targets can be operated in any part of the area, by eight independent lines, at any speed up to the cavalry charge.

Heather about a foot high covers the sandy ground; there are many small bushes, and evidence was not lacking that the target sleds surmounted these without capsizing. The targets impressed me as very practical.

In reply to a question, the general said that infantry goes forward under artillery fire in *every problem*, just as in war, but "we do not permit them to approach within 100 or 500 meters of the target, for fear of accident." If this practice is general, German infantry in the next war will be little disconcerted by the screaming of its own shrapnel.

TERRAIN.

The maneuver area was, roughly, thirty miles square. It is a rolling country, with no large streams or mountains, bounded on the north by the Hartz Mountains and on the south by the Thuringian Mountains, both heavily wooded. A forest stretching east and west ten miles, from one to three miles wide, lies about ten miles south of the northern border. Smaller bits of forest are scattered here and there. The country is generally cultivated, and nearly all slopes are convex, a condition favoring aggressive movements and rendering defensive operations difficult. The farmers do not live on their land, but in small compact villages, invariably located in valleys. These are very picturesque, and generally clean; but as the stock shares the house with the family, and stable manure is carefully preserved, often in neat piles in the center of the street, they are not nice places to stay. Fences, walls and bridges are practically unknown in that part of Germany, except within the "dorfs." The crops were all off except sugar beets and potatoes, and these were avoided when possible.

The weather was generally very dry, the ground baked hard. Owing to this, comparatively little fall plowing had been done. The lines of trees bordering main roads made it easy to pick up localities, and the map was much used for ranges.

There were few large towns. Mülhausen has perhaps 10,000, Nordhausen 8,000 and Sondershausen 5,000 houses.

ROADS.

The roads in Germany may be divided into four classes. The first are the *chaussées*, indicated on the General Staff maps by solid double lines with dots. They are in general from 25 to 40 feet wide, with ditches (usually passable by all arms) on both sides, and rows of trees just inside the ditches. The center of the road is either paved or macadamized for a width of from 12 to 20 feet. Between this and the trees are earthen paths; frequently one is reserved for bicycles.

The second class is indicated on the maps by solid double lines without dots. They are much narrower, usually have but one row of trees and one path, or none at all, and have a top dressing of stone or gravel along the center. The first class are kept in perfect condition, and the paved portion is always wide enough for vehicles to pass each other; in the second, the surface is often rough, and generally the outer wheels of passing vehicles are off the paving.

All roads are of very low crown, so that walking is as easy near the edges as in the center.

The third class, indicated by broken double lines, corresponds to the ordinary dirt roads of America. The fourth class, indicated by solid single lines, corresponds to lanes in America, but without fences. They occur everywhere, often at regular intervals of a kilometer or so, and are simply strips of uncultivated land two or three yards wide, lying between land holdings, and intended to give access to them without going across cultivated areas.

Bridges are almost exclusively built of stone, and except in the neighborhood of cities are usually too narrow for vehicles to pass each other.

America could learn much from Germany in respect of roads and bridges. Forty-foot roadways seem to be in demand with us, where sixteen feet would answer every purpose and double the mileage to be had for the same cost. Again, our roads are invariably so high in crown that only in the center is walking comfortable.

RATIONS.

The sufficiency of the ration is best attested by the excellent physical condition of those who use it. The base of it is brown

bread, made of rye, of very close grain, retentive of moisture, not readily damaged by anything, of great weight in comparison to bulk, and (I speak from personal experience) of more sustaining quality than any other. It is baked in huge loaves, and a six-pound section is given each soldier every fourth day. In garrison he usually keeps it in his locker between meals; in the field it goes into his bread bag. What is left on the fourth day is slightly damaged if at all, in spite of weather, carriage and age. It may be dirty, but if so it is its owner's fault. One can go all day with nothing else to eat and feel much better than after a day on our emergency ration. If the train should fail to come up, I am satisfied that the German soldier could subsist with slight discomfort for at least two days, and possibly longer, on his six-pound chunk of black bread. Thus it constitutes an excellent substitute for the emergency ration; however, the latter is in use and was issued during the maneuvers. It is a compressed cake, less bulky than ours, not dependent upon a tin can for preservation of quality or security from loss, can be eaten like a piece of chocolate or made into soup or stew. It is palatable and satisfying in any form.

Cooking carts are coming into general use; it is intended that each company shall have one. Each is drawn by two horses, and looks like a caisson, the body being the stove, and the limber a receptacle for stores and cooking utensils. Its capacity is extremely limited. Under field conditions with us, the company wagon with range and Buzzacott frame is vastly superior; and if to this is added a fireless cooker, the one advantage of the kitchen wagon, feeding the men wherever desired, is fully balanced.

In maneuvers the troops are quartered on the people, who feed the uninvited guests, receiving therefor one mark (twenty-five cents) a day for soldiers, and two and a half marks for officers. This renders the ration question a simple one, but it is apparent that, with armies concentrating, local supplies would be quickly exhausted, and would at best suffice for but a small part of the troops; hence the kitchen wagons, and the training in field cooking, of which there was much more than I expected to find, and more than I ever saw in a maneuver camp in the United States.

There were three bivouacs, and individual cooking was required each time. One of these was at the end of a thirty-five-mile march. Emergency rations supplemented by the inevitable rye bread made an excellent meal. The mess kit is better than ours, and anyone

with sense enough to boil water can use it. Ours requires an expert, and he usually gives up in time and attempts nothing more elaborate than frying bacon and hardtack in the fat, to the detriment of his digestion.

Each squad carries six or eight small iron rods about twenty inches long. A fireplace is prepared by digging a hole about two feet square and six inches deep. A rod is set up in each corner, and the other rods are hooked into these, connecting them, so that a frame is constructed about a foot high, triangular or square according to whether six or eight rods are used. A fire is built in the hole, and cooking utensils hung on the rods by small iron hooks.

A very useful thing is the water bag. It is a canvas bag about twelve by eight inches, twenty inches deep, with two handles of the same material; it is rolled up and carried by one of the men in each section. When water is wanted, two men go to the well and return with the bucket between them. One never sees a mob of thirsty men quarreling about a well, trampling the farmers' gardens, getting left behind on the march, etc., nor does one see individuals loaded down with canteens trying to get them filled. In camp a hole about a foot deep is dug to receive the bag, to avoid danger of collapse.

QUARTERS.

Barracks in no way compare with ours, in construction, care, comfort or anything else. Economical as the Germans are, it is surprising to find the waste in barracks in the way of dark halls, etc. The most modern barrack I saw—but did not enter—is about three years old, is well supplied with windows, well placed for air and sunlight, and looks much like an American building. This was at Königsbrück, one of the great firing grounds; and perhaps the most noticeable thing of all there was that American ideas are being followed in the buildings, but not the American custom of ruining a reservation by scattering buildings all over it. The buildings are grouped in one corner; no land is wasted. The old quadrangle system is wholly departed from, even the barrack yard wall is missing, but a heavy barbed wire fence around the whole reservation obviates the necessity for guards except at a few gates.

On maneuvers and in war, so far as practicable, troops are quartered on the inhabitants. This is simple, economical and healthful.

So far as I could see the soldiers are quite welcome in most houses.

All horses are stabled, and guns put in enclosed courts. This makes serious mistakes possible. A Blue officer's patrol one night passed through a town occupied by a Red force consisting of a battalion of infantry, a battalion of field artillery and two squadrons of cavalry, and reported it free of the enemy. It chanced that this force in the morning came up in rear of that to which the patrol belonged, and had a decided influence on the events of the day. The Blue commander had taken the patrol's report at its face value, and sent his observation parties elsewhere, leaving the way open. As it was known that Red had outposts, an investigation was begun. The patrol *had* been through the town, and the outpost *had* been on the alert. Of course the patrol should have wakened inhabitants and made inquiries. On another occasion I went on a visit on a rest day to a battalion of artillery quartered in a small village. The men were at stables. But for the names of the officers on the doors of their quarters, and a very few men about the streets, there was nothing to indicate that troops were in the place. Not a gun or horse was in sight. At Stettin, a city of 200,000 inhabitants, 15,000 men disappeared in the houses, and no one would have suspected that the usual garrison had been trebled.

Small details always precede the troops to a town. Ahead of these has been sent a letter to the mayor. The latter gives orders to the police, and when the details arrive they have only to go about and chalk on the doors of the assigned houses the number of men and the organization. A town of 10,000 people will contain at least 2,000 dwelling houses, so that 4,000 troops could be easily accommodated, or even double that number. I seldom saw a higher number than three chalked on a door. Officers either go to hotels or are quartered on the better families. People who do not want to be bothered with the soldiers send them to cheap hotels and pay the bill, from fifty cents to a dollar a day.

An interesting feature of German army life is the very sensible "striker" system. Each lieutenant is entitled to one soldier, each captain two, and each field officer three, as personal servants. They get full military training, but live in the officer's house and do every kind of servant's work. Something on that order would ameliorate the trying conditions of life at some of our posts. We could not

adopt the German system, where the soldier has little choice in the matter, but freedom to make private arrangements with the soldier would be sufficient.

All mounted troops enjoyed quarters on maneuvers, for the sake of the stock; all animals are stabled if it is at all possible. So the infantry as usual gets the worst of it. One cold night they lay in trenches with no protection but their light cloaks. Half the night was spent in digging in the hard ground, and they did not need sentinels the rest of the night, for it was too cold to sleep, and everybody shivered and growled and hoped the enemy would attack: after being captured they would be permitted to light fires.

The shelter tent is a square of canvas about the size of ours, but without the triangular piece, and with buttons and buttonholes all around. The tents are never pitched singly. A common formation was to button them together, forming a long tent for a whole platoon. The three tents of a company would form three sides of a square; the officers' tents, made of from three to a dozen halves, would be in the open side, sometimes also a similar tent for the non-commissioned officers. In the center of the square a log about a foot thick and four or five feet high was usually set on end, a ditch a foot deep dug around it at a distance of four or five feet, and the earth banked against the log to the height of a foot. On this bank firewood was piled. It made a rattling campfire; officers and men would bunch up around it, mingling with much more freedom than is customary with us, and companies would vie with each other in singing songs. No sanitary arrangements were ever apparent, but neither did the bivouacs become fouled; I think the entrenching tool is put to proper use. The tents were always trenched and banked regardless of weather, and the air within must have been most foul; but Germans ventilate little anyway.

STAFFS.

The corps commander had a colonel and a captain of the General Staff, and a personal aide. The division commander had a major or captain of the General Staff, and an aide. Each brigade commander had a captain or lieutenant as brigade adjutant. A few of the officials of the Intendance, corresponding to our Quartermaster, Commissary and Pay Departments, were about, but they were rarely seen and never heard. The General Staff, selected from the line

of the Army, constitutes its head, and there is never any question of administrative and supply officers stepping into the ranks of the fighting men. The whole staff of the corps, two divisions, one cavalry brigade, two artillery brigades and four infantry brigades, was less in number than is sometimes seen at one of our maneuver camps where the troops are a third of the strength. Of course it meant work. A brigade adjutant was often late getting out his orders, and the adjutants waiting for copies sometimes did not get to quarters until near midnight. Then the commanding officer would be called and the subordinate orders worked out.

A certain officer, as a lieutenant, was adjutant of one of the infantry brigades. He received his captaincy, but was continued on as adjutant. During the maneuvers his assignment to a company arrived. He was delighted, his general congratulated him, and so did many others. We asked why; our adjutant looked at us in blank astonishment,—“why, he is to be a company chief!” Fancy one of our infantry captains receiving congratulations on being relieved from a general's staff and sent to join his company; will that perspective ever be common in our army?

A number of student officers were present at the maneuvers. With us they would have been umpires regardless of qualifications; not so with the Germans. A coast artilleryman, a grenadier of the Guard, and two line infantrymen, were serving as subalterns with an artillery regiment; cavalrymen trudged along on foot with infantry companies; field artillerymen and infantrymen rode with the cavalry; an engineer commanded a platoon of siege howitzers; and an infantryman commanded the train of the pioneers. That system should have a wholesome effect on the future generals.

Each officer of the corps was provided with a General Staff map of the maneuver area, on a scale of less than an inch to the mile. This was the only map used. Some sketches, mostly panoramic, were made, but there was no attempt at extended topographic sketching.

All the situations were made before the troops took the field, and headquarters knew where each unit was to be quartered at night. This was not permitted to affect the conduct of the maneuver for the day, the commanders of the troops being kept in ignorance of it until after the critique, but whatever the outcome the troops were sent to the places previously decided upon for quarters. This resulted in one side having to march twelve miles to quarters after

the battle; on another day a brigade that had already marched thirty miles had five to go to bivouac. There was never any preliminary assembly for these marches to quarters; as soon as the critique ended the officers joined their commands, and every company started in a bee line across country for its village. If a battalion or regiment happened to be in closed formation it marched as a unit; if the scattered companies happened to converge on a road, they formed column just as they came in, regardless of their normal place in regiment or battalion. This saved time, and the celerity with which a field was cleared was remarkable.

Only general and field officers acted as umpires, and the command of opposing parties changed daily. This, with the detachment of umpires, gave subordinates their chance. A lieutenant colonel was the lowest ranking officer I noticed in command of a detachment. His detail relieved the colonel of cavalry, the colonel of artillery, the colonel of infantry, and perhaps one or more lieutenant colonels who may have ranked him, so that quite a number of subordinate officers exercised higher commands that day.

No distinctions or discriminations were made, all field officers of all arms being on the roster. In two of our maneuver camps of 1910, field officers of field artillery were deliberately left off the roster on the ground that they were of a special arm, and not fitted to command mixed troops. This is a dangerous idea, and one that our corps must combat whenever it appears, not by grumbling, but by immediate and written protest. A field officer can scarcely be expected to know the technical handling of other arms than his own, but he can and should know how to handle them tactically; if he does not, he is out of place on the active list.

CAVALRY.

The cavalry, like the infantry, seems to be about twenty per cent below the official peace strength. It clings to its distinctive bits of uniform; its officers are better mounted, its enlisted men not so well mounted as ours. Dress is the only distinction; all have the same organization and carry the lance, saber and carbine. Pistols are to be issued in war. The soldier does not ride so well as ours, but his horse is trained to the gentleness of the doctor's nag.

There is much opposition yet in our service to the double rein, but these German soldiers, not at all the equal of ours in intelligence

and native ability, encumbered with a heavy helmet, an ornamental but cumbersome shoulder belt, huge clumsy boots, a carbine that is often carried all day slung on the back, a lance that keeps the right hand always occupied, manage the double rein; however, the reins are so short that a man has fair control with the hand resting only in the bight. His gait is the walk; if time is important, the slow trot. Very exceptionally is the fast trot or gallop used. In column on the road the horses walk up with their heads between the croups of those in front; I thought it careless marching at first, but it reduces the length of column thirty per cent.

Great attention was paid to patrol work, and apparently none to spectacular attempts. The infantry were not slow to say that the cavalry are really mounted infantry; the cavalry say they are much superior to mounted infantry, but admit that they depend more than ever before on dismounted fire action. This tendency was well shown one day when the Red cavalry division got on the flank of a Blue column unobserved, and attacked from less than 1,000 yards with eighteen guns and ten dismounted squadrons; the remaining five squadrons remained mounted as a reserve. It was a complete surprise to the Blues; a better opportunity for a mounted attack could not be desired. However, the attack as carried out was fully approved by higher authorities. Some hours later this division found itself on the flank of the victorious Blues, who were on the point of carrying the Red position. It looked like that psychological moment one reads about, and there seemed nothing to prevent, but again ten squadrons dismounted and advanced to the attack. The halt sounded before their attack was well organized, and the exercises ended. Not much doubt as to the conduct of German cavalry in the next war!

On one occasion a regiment of Red cavalry covered the right of its division, and a Blue cavalry regiment started for it. Red was in the open; Blue took to the woods, and was seen no more. But it was within 1,000 yards of Red when the latter moved slowly off toward the opposite flank. Neither, apparently, was aware of the proximity of the other, although patrols from both were running about. To an onlooker it was unaccountable. Red's withdrawal left a whole regiment of Red artillery, scattered about in ravines, uncovered and unsupported, except for about half a squadron, who were content with sending out a couple of patrols toward the woods. The rest stuck their lances in the ground near a battery, and sat

about on the ground watching the gunners at work. There was something familiar about the conduct of that support.

But the Blue cavalry continued to feel its way along in the woods; Blue patrol leaders continued to send frantic messages; the Red artillery suddenly discovered its exposed position and called for infantry; and after nearly an hour's exposure to a cavalry regiment that was never more than 1,000 yards away the artillery was covered by a company of infantry sent from the reserve. Some Blue cavalry appearing at the edge of the woods, the infantry opened a lively fire, and kept it up on a wide front. It had the desired effect; Blue continued on in the woods looking for the chance that had passed.

Hours later Red came up on the right rear of two Blue batteries, ten miles from the former scene. The batteries were covering the Blue retreat, and were wholly unaware of Red troops being within two miles. The right battery had just limbered up and was moving off in column across the rear of the other. Red was in column of squadrons, and the leading squadron suddenly appeared over a crest three hundred yards in rear. With astonishing rapidity the withdrawing battery executed "action left" and began banging away. The three right guns of the other battery quickly faced to the rear (the others could not, as the withdrawing battery was in the way), and all nine guns got in one or two shots before the horses were so near that fire had to cease for fear of injuring someone. The squadron, very much scattered, rode on through and claimed a capture; the remaining four squadrons followed at about two hundred yards and received the fire of the artillery. As the personnel of only the four middle guns would have been at all affected by the charge of the first squadron, the decision of the umpires that the cavalry was wiped out, was probably good.

This was the only mounted attack of any consequence so far as I could learn. It should have succeeded if it had been properly conducted. Perhaps the cavalry were so sure of their prey that they were careless. The artillery showed remarkable decision, promptness and discipline in meeting the attack.

I was often led to question whether the superior mounting of the officers is really a good thing. In this charge, and in other cases where rapidity was essential, they got far ahead of the men, and in war would have been uselessly sacrificed. It also resulted in the lines breaking, and instead of a solid line striking the enemy there

came a scattered swarm. In the case of the squadron just mentioned, the area covered by it at the instant of contact was a circle with about fifty yards diameter.

There is no question that German cavalry ideas have undergone a great change in the last few years; and it is worthy of note that the conduct of the American cavalry in the Civil War is receiving a great deal of attention.

Cavalry patrols were numerous and energetic, and covered great distances with remarkably little detriment to their horses. This was largely due to never going faster than a trot except in emergency, and to patient, steady work with no attempt at hurry or dash. I also think that rising at the trot is conducive to sparing both horse and man. On one day I made forty-five miles myself, over all sorts of country, ending in such good shape that I was greatly surprised when I learned the distance. I am satisfied that with the McClellan saddle and the close seat neither man nor horse would have been in such good condition.

There was a surprising latitude allowed the patrols, and not much effort was made by either side to prevent the other getting information and carrying it off. A former observer from our army commented sharply on this in one of the service magazines some time ago. The fact is that the Germans make a deliberate choice between two evils. To permit patrols to get information and get away with it is an evil, but to prevent them from doing so deprives them of practice in observing and reporting, and so is considered the greater evil of the two. Of course they do not mingle indiscriminately; that would be foolish; but each is content with keeping the other at a little distance, and wastes no time in attempting captures.

A messenger does not salute any officer, nor address him by his title. A courier approaches at a gallop: "Commander of the advance guard," he calls out; every officer who knows calls out or points to the officer wanted; the messenger rides directly to him, and, without dismounting or any formality announces, "Patrol 3d Hussars; hostile battery entrenched on west end of Kuhberg, supported by one squadron of cavalry." An officer is sent for; he rides up to his superior, who may be of any rank, sitting, standing or mounted, receives his orders, salutes and rides off again; no time is lost in dismounting and remounting, nor words wasted in "give my compliments." Messages of general import are not sent to individuals; instead of "tell the commanding officer, 71st Infantry,

to move at once to Rohnstadt," the message is "the 71st Infantry will move at once to Rohnstadt."

The German officer is a gaudy creature; the details of dress and deportment are seemingly endless. But in the field he certainly eliminates everything but the essential. A messenger comes trotting back from the front; an officer calls out "what news?" "Jonesville free from enemy" comes the reply, flung over the rider's shoulder, with neither title nor "sir" nor delay.

ARTILLERY.

The uniform is dark blue, with black velvet collar and cuffs, except in the XII and XIX Corps (Saxony). The Saxons wear dark green, with red collar piped with black. A white shoulder belt and waist belt add greatly to the appearance of the uniform, but also enable one to recognize artillery at great distances. A bursting bomb, much like that of our Ordnance, is the usual insignia. Shoulder straps are mostly red, but there are some of green, blue, yellow and white. The helmet spike terminates in a knob instead of a point. The trousers are dark blue; breeches are little worn.

The harness is of black leather, invariably very old and much patched. The curb bit is used generally. The collars are of leather, much like the commercial collars in this country. Some hames are of wood, some of iron; some are of the style used in buggy harness in this country, others like those of our wagon harness. A collar with an iron front instead of hames was noticed; from their scarcity and worn condition I fancy they are a rejected experimental type, being used up,—for the German wastes nothing. The saddle is a light iron frame partly covered with leather. The general lines are those of the flat saddle, but for some reason the cantle is an arch terminating in a point, something like a Whitman saddle, but at least ten inches above the horse's back; mounting is difficult. The traces are of ordinary inch rope. The splinterbar is quite generally used.

The organization is familiar, so I shall not mention it, except to say that the heavy artillery is designated "foot artillery" and is not a part of the field artillery proper. Four batteries of it, howitzers of about seven inches caliber, participated in the corps maneuvers. They used indirect fire exclusively, from positions well in rear.

The field artillery peace strength is small, only eighty men and

fifty-eight or sixty-eight horses per battery of six guns. In maneuvers only the guns and observation wagons were used. Reservists, except officers, do not go with the batteries on maneuvers, as there is no way of carrying them along. They get their training in garrison.

No forge or store wagon is taken on maneuvers. One fore and one hind shoe, fitted, are carried in special saddle pockets on each horse, and the village smithy is used, the proprietor being paid five pfennigs ($1\frac{1}{4}$ cents) per shoe for the coal consumed. The work is done by the battery smiths. Repairs to materiel are similarly made.

Indirect fire was the rule, and, in fact, the whole handling of artillery in action might have been patterned after the principles laid down for our service. But the Germans have recognized the fact that without proper observation fire is wasted, and have done everything possible to provide for it. Every battery has an observation wagon drawn by four horses, carrying telescopes, an observation ladder with shield, telephones, range finders, etc.

The ladder is an ordinary tripod affair of steel pipe, in three sections, and stands, extended, about twelve feet high. When folded it makes a bundle about a foot in diameter and six feet long. It is carried in an opening in the wagon chest, lying on the trail. The shield, about five feet by two, of light steel, is in two pieces, and is strapped upon the chest. When the ladder is in position the shield is hung near the top and the observer looks over it. If elevation is not necessary, only the upper third of the tripod is erected, and the shield attached.

The telescope has two tubes, which have a rotary movement away from each other. Both eyes are used. There is a slight eccentricity to allow for difference of width between the eyes, and the tubes can be set at any angle with each other, or horizontally, so that one is looking out at each side of the shield. Barring this feature the instrument is simpler than ours. It has a universal joint and a single circular level. This is made at right angles to the axis of the instrument at the factory, and can only be damaged by breaking; it is quite fool-proof. The deflection scale is on the outside of the cylindrical head of the instrument itself, hence is visible all around, and there is no glass to break or become dusty. Angle of site measurements are made independently of the level of the instrument.

Only buzzer wire was used with the telephones, which were used as little as possible. When they were, the language and actions in their vicinity reminded me strongly of what is only too often seen and heard around our own. There was a good deal of "fudging" going on, too. Quite frequently batteries were busily firing from behind crests that the projectiles could not possibly have cleared at the ranges used.

No particular care was taken in coming into action to get the gun intervals accurate. It was quite common to see the six guns of a battery at everything from ten to forty yards interval. Often the observation wagon was within ten yards of a flank gun. Once a gun had to be moved after the first shot or two because the battery commander on his ladder could not stand the blast. Under his personal direction the ladder had been erected about ten yards to the right front of the flank gun. I judged from the appearance of the materiel that the observation wagons and ladders were a new thing, and I was told that this was the case.

Little attempt was made to secure the limbers. They invariably halted in rear of the batteries, from fifty to a hundred yards distant, sometimes in line or column facing the guns, sometimes facing to the rear, more often in line without intervals at right angles to the battery front, where a single shrapnel could wipe out the whole lot. I do not understand this; it might be accident or design. In conversation with infantry officers I learned that they consider it proved at the schools of fire that the safest method of advance under artillery fire is in small columns; perhaps some attempt is being made to apply this to the disposition of limbers. I might remark, however, that I did not once see it used by the infantry. They invariably deployed as skirmishers at from five to ten yards interval, even 4,000 yards from the hostile position. Even the supports did this.

In one night affair the artillery of the defense was entrenched in, or just in rear of, the infantry line, along the crest of a hill, whose slope toward the enemy was convex. Just at dawn the enemy came, completely hidden, quite close to the crest, and with one rush carried everything. The remaining batteries, half a mile in rear, were able to do some good. Those placed in the infantry line were simply thrown away.

In the corps advance against a marked enemy, the batteries of the latter (one gun each) were on or near the infantry line, and

were mostly captured. Better work could have been done and their safety assured by taking good positions that offered to the rear and within a mile of the line.

Little disposition was ever shown to get away from a position. Except on the second day of the corps maneuvers, the artillery calmly allowed themselves to be taken, though usually a timely withdrawal could have been effected. On the occasion mentioned, all the artillery of the Red division was taken but one battalion, which limbered up, raced to a good position about 1,000 yards to the rear, and opened a terrific fire over the heads of its retreating infantry. It was good work.

The limbering up and moving off was always unaccountably slow. I timed one battery. It took four minutes, and was under heavy infantry fire all the time at two hundred yards. Perhaps there is some psychological idea in this; I know the infantry are forbidden to retire at a faster gait than the walk, though they may advance as fast as they like.

But the artillery certainly does not, and can not, maneuver as does our. In the first place, their horses are not nearly so good. Then their method of limbering up is very clumsy, the limber halting almost anywhere in rear of the gun while the cannoneers roll the latter up to it. There is no neckyoke, and the pole threshes badly; and usually when the trail of the gun is engaged it flies up between the horses as far as the chains will permit, which means that its forward end is higher than their heads, and both invariably dodge. Then the cannoneers climb into place and it rights itself. A sudden stop, or cessation of draft, also throws the pole into the air.

But for the actual business of getting the guns to the firing point the German horses are certainly well trained. They are as quiet as plugs, and they trot for miles at a time uphill and down, and they pull their very hearts out on ploughed hillsides. I saw a whip used but once, and then it was only a threat.

Entrenchments were frequently used even in covered positions. No rule seemed to be followed; sometimes pits were dug, sometimes only pits for the cannoneers, the earth being thrown up outside the wheels. Each battery seemed to have its own ideas, and sometimes two or even more types would appear in a single battery. Several batteries had sacks about five feet long and something less than a foot in diameter; these they would fill with earth and stand

on end, forming a sort of "lean-to" outside the wheels. That idea seems rather good.

Economy is the watchword with the German army, and that dictates the small peace strength of the batteries. They have the reserve caissons for war, and will hire or impress horses. Of course they know exactly what horses each battery will have, but the fact remains that those horses are not trained for their work, and for the firing battery the peace establishment must suffice. Why can we not do the same? Suppose each of our batteries reduced to a peace strength of four complete gun sections and the present ninth section. Each gun would be ready to go into action with 146 rounds of ammunition. Long before that was expended the second line, untrained caisson companies or four-mule wagons (each can carry as many rounds at minimum loads as a complete caisson) could come up. Each of our light regiments would thus free twelve sections, or thirty-six in all, including the horse batteries forty-eight in all,—enough to man and horse nine and a half light batteries, nearly two additional regiments, with no extra cost to the Government but that of the additional officers; surely not an exorbitant price to pay for such an addition to our far too small corps. Two complete regiments could be formed by substituting mules, driven by line, for the horses on the forge and store wagons. These form no part of the fighting or maneuvering battery, and there is no excuse for their being horsed.

Germany, under the absolute necessity of being ready at all times to concentrate on the frontier in a few days' time, considers a firing battery of six guns, one observation wagon and three caissons, with less than half the total war requirement of men and horses, a safe proposition. How much more, then, can we, who must improvise the larger part of our forces anyway, and will probably never be reduced to such short notice? Maneuvering batteries are slow to train; caisson or wagon companies can be organized quickly.

Germany has one gun to eleven horses and twelve men; we have one gun to twenty-five horses and thirty men. Which nation is getting the greatest returns on the money invested?

A peculiar and important part of the German Army is the "einjährigens." These are men who serve but one year in consideration of supporting themselves. They do not live in barracks, they pay all expenses, even that of uniform, and in mounted commands frequently

furnish their own mounts. It goes without saying that they are men of means, generally educated, the majority from the classes that furnish officers. They serve in all enlisted grades, and sometimes receive commissions in the regular army, more frequently in the reserve. There are a great many of them; their distinguishing mark is a blue and white, or black and white, piping on the edge of the shoulder straps. In the artillery the special details were largely composed of these men, and in the cavalry they are much used in patrolling. The average German soldier is not noted for intelligence, but the places most requiring it are filled by this class.

Twenty-five per cent of the artillery of each division is howitzers. There is little to distinguish them at a distance from the guns, but to reduce the size of port the top of the shield is curved to the rear. They are about the same weight as the guns, and their tactical and technical handling seems the same.

Smokeless powder was used for blank firing. This is immeasurably better than black. It was very difficult to locate hostile artillery, but I made the, to me, interesting discovery that it is possible in time to locate the direction of hostile batteries by attentive listening. Having determined the direction of a battery, its approximate location on that line could often be established by a study of the map and ground. This is worth knowing. Our use of black powder for blanks betrays instantly the artillery position, deprives the artillery of the opportunity to learn such facts as this, gives information that they would not have in war to the troop leaders,—in fact, creates false and pernicious ideas and conditions. It should be abolished.

INFANTRY.

The peace strength of the company is officially called 150 men. I counted companies again and again, at drill and marching, in different parts of the country, and was puzzled that the number invariably fell below 120. At Stettin, it was 140 to 150, but there were reservists present. In the XI Corps the strength was about 120, and there were reservists present. Finally it came out that the peace strength is 125. Why it is reported officially as twenty per cent greater might be guessed.

I saw nothing of the Landwehr except some on duty at the Artillery Depot at Wurzburg, where I witnessed an incident that could not have happened with the active army. I entered the

chapel in the Marien fortress, to find therein an officer and two non-commissioned officers of the Landwehr, all with their caps on, and one seated on the back of a pew. The protest of the guide was instant, emphatic and effective.

Captains are mounted; and any lingering doubt I had as to the wisdom of this is gone. In a score of ways its advantages were apparent.

I have no comment to make on dress except to say that theirs would be absolutely impossible in our country in summer. In the first days of the maneuvers the days were warm and dry,—delightful autumn weather, I thought. I was comfortable in a medium weight woolen service uniform, and would have found khaki entirely too light. The troops suffered somewhat from the heat; one regiment after a two hours' march in the early morning was halted for a whole hour to get in shape to go on, and one heard at every critique talk of the intense heat. It never attained either the temperature or the humidity of a pleasantly warm June day anywhere in the Middle West, not to mention our July or August. After spending in Germany the whole of the hottest summer known for fifty years, I am convinced that in any comparison of food, forage, clothing, care of troops, performance of troops foot or mounted, etc., a very large handicap must be allowed the United States. For instance, in the corps maneuvers an infantry brigade marched thirty-five miles in one day, five or six of it through fields, participated in an engagement for two hours, and was in bivouac in good shape by six o'clock. That was good work; but considering roads, fields, dust, temperature and humidity it was not a more severe test than the twenty-seven mile march of our maneuver division from Leon Springs to Fort Sam Houston last June.

The marching of the infantry is exceptionally good; the step is quick and long, and one is constantly surprised at the apparent suddenness with which changes of position or formation are completed. There is little double-timing, but really there seems no need of it, the quickness of decision, brevity of orders and celerity of movement precluding the necessity for hurry. Several officers assured me that the principal factor in acquiring this marching ability is the ridiculous "parade step;" that it is the best exercise possible for the purpose, and that this has been recognized and the step adopted by various other nations.

I know from personal experience on hunting and mountain climbing expeditions that a great advantage is conferred by the pack being carried by back and shoulders, leaving the chest free for breathing. Then again, the infantryman carries his pack whenever he does his gun,—drill, parade, guard, etc. But the said pack is not filled with bricks to bring it to "war weight." In garrison the knapsack, water bottle and bread bag are empty, in maneuvers they are filled, but in neither case are the cartridge pouches carried. Again, nothing is so carried as to flop against the walking muscles,—an immense advantage over our abominable haversack.

Development was usually made as near the hostile position as the ground would permit, which on that open terrain meant from one to three miles. Rarely did the columns continue in march if there was any reason to suspect that hostile artillery had observed them. From the development, deployment and advance begin. Usually each company in first line sends forward a platoon as skirmishers at from three to ten yards interval, the other two platoons following in similar order at 100 or 200 yards. Never did I see the line of small columns used, although assured by several that it had been decided at the schools of fire that it is the safest method of advance under artillery fire. The second and third lines followed in similar formation at 300 and 600 yards. Each company, battalion and regiment has its own support, and this, whenever possible, assembles in close formation. In fact, no opportunity is neglected to get small units in this formation when they are not firing or under fire. It is an excellent plan, and helps wonderfully in maintaining order, discipline and efficiency.

The advance of the firing line was never by any particular rule, but according to the ground, etc. Rushes by alternate platoons or companies were much used, but no attempt seemed to be made by troops on the right and left to cover the advance by fire. This drew sharp criticisms from the higher commanders, tempered, however, by acknowledgment of the difficulty of obtaining co-ordination in the stress of battle.

There was little attempt at straight lines or regular intervals. The firing line usually filled to one yard interval by the time medium ranges were reached. And here a curious thing was often seen. After the whole force had been carefully brought across the artillery zone in widely scattered formation, troops brought up to the firing line and finding no room would form in small

close columns and lie down just behind it, advancing when it advanced. These might have sufficed to replace losses. Losses are assessed by directing say-every tenth man to remove his cloth helmet cover; but these men remain in the line, and hence the lack of room. The Germans reckon on losses from casualties and stragglers of a third of the troops in first line, and this, rather than any tactical consideration, is the reason for the third platoon. It is always the company support, and rarely gets into the firing line for the reason stated above. The front of a company on the firing line is then, practically, that taken by two-thirds of the men, lying as close as possible in single rank.

Charges were always slow, without fixing bayonets, usually with little enthusiasm, and broken and disjointed. Not infrequently a company would be seen charging alone. Often the advance continued up to within a hundred yards of the hostile line. Much of this close work was absolutely impossible, but I believe it is purposely allowed, as being interesting and amusing for the men, and not harmful.

As soon as the charge goes home every company rallies, and the battalion supports rush forward into the gaps. This is due to the French system of timing the counter attack to strike just when the charge has spent its force.

Bicycles were in every infantry regiment, and were used a great deal. Anything short of ploughed ground was considered good going. They were extremely useful for messenger and patrol duty. Motorcycles were not used at all. The division and corps commanders used high power automobiles.

Each company commander carries a flag a foot square, usually stuck in his boot top. All in a regiment are different. He uses it in directing his men or signalling to others. It was no toy, but was in constant use, and was most valuable.

The extensions practiced by the infantry were not at all what I had been led to expect. The wide extensions, the successive lines of skirmishers, the gaps that were considered non-existent if they could be readily swept by fire, the staking of everything, even to the last battalion of the reserve, all were very Japanese. It is high time that we were digesting and assimilating the lessons of the Manchurian campaigns. Instead of waiting for German writers to give us a new set of ideas, we might formulate a few for ourselves.

Provisional machine-gun companies accompanied each infantry regiment. Each gun is carried on the rear chest of a carriage resembling a caisson, drawn by two horses. A few non-commissioned officers were mounted; the detachments walked. The gun is on a cradle, allowing lateral and vertical motion; this is mounted in a sort of hand-barrow. The carriage is driven as close as possible to the position, the gun lifted off, and two men carry it into position. The other men carry ammunition boxes from the chest. I have seen the guns carried a quarter of a mile at the double in this manner. The organizations were to be made permanent October 1. Blank cartridges can be used, and the guns seemed to have an unlimited supply, so that their drumming was ceaseless. The Germans have great respect for them, and probably some psychological idea is back of the lavish expenditure of cartridges. For the rifle ten rounds per day are allowed in brigade, twenty in division and thirty in corps maneuvers.

FIRE FOR EFFECT WITH THE THREE-INCH GUN.

MAJOR W. S. MCNAIR, 6TH FIELD ARTILLERY.

Cost of ammunition prevents much fire for effect at peace time target practice, hence officers are apt to neglect proper consideration of its various phases. The following discussion is intended to set officers to thinking on the subject. In a similar discussion Capt. Tréguier of the French artillery arrives at somewhat different conclusions on some points, on account of having used too few positions for targets and too few ranges.

The first part of this paper will be taken up with the method of effectively covering a bracket with time fire when the target is seen and has been clearly bracketed. Other parts will concern shrapnel fire at targets behind a crest.

TIME FIRE AGAINST A BRACKETED TARGET.

Before considering the subject of searching a bracket with time fire one must have some knowledge of the relative effects of salvos when the target is in various positions with reference to the bursts.

The following purely theoretical discussion of the distribution of the buffets of a single well adjusted shrapnel is introduced to prepare the reader's mind for the remainder of the discussion.

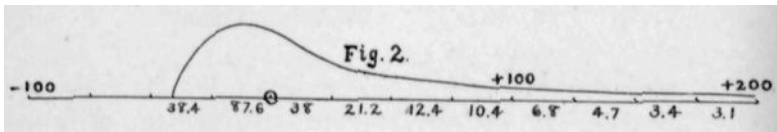
Let us assume a shrapnel fired with such elevation that it has a range of 2,850 yards and a height of burst of three mils or 8.5 yards.

At the point of impact let a plane be passed perpendicular to the axis of the sheaf of bullets. Assume that the bullets will be evenly distributed over a circle in this plane, the center of the circle being at the point of impact. The curvature of the trajectory and of the separate trajectories of the bullets and the known irregularity of the distribution of the bullets are neglected for the sake of simplifying the discussion of the problem, the curvatures being too slight to affect the principles of the discussion and the regular distribution best representing the average effect.

Through the point O representing the point of impact (Fig. 1) draw a horizontal line representing the ground and lay off on it in each direction 25 yard divisions. Draw two lines B C and B A representing the top and bottom elements of the cone.



Between these lines draw straight lines from the bursting point to each of the 25 yard divisions. The line A C will then be a diameter of the circle containing all of the bullets and the divisions of that line by the lines radiating from B will each be the height of a zone of the circle through which pass all of the bullets which strike in the corresponding 25 yards space on the ground. The areas of the zones will then furnish a measure of the distribution of the bullets along the ground. By actual construction to a large scale the number of bullets falling in each 25 yards space was found to be as indicated under the line in the spaces of Figure 2.



By plotting these numbers as ordinates from the middle of their spaces the curve shown above the line in Fig. 2 was found. Any ordinate of this curve then represents the relative density at the point from which it springs from the horizontal axis. Inspection of this curve shows some interesting facts; for example,—

That the maximum effect of a single shrapnel is a few yards behind the point of impact; that the effect falls off very rapidly to zero in rear of the maximum; that the effect falls off quite rapidly in front of the maximum at first, but that at about 25 yards it begins to fall off less rapidly and finally tails off for two hundred yards to a very small effect; and that some 39 bullets are left to cover all of the remaining space beyond 200 yards which their velocity will permit them to reach, the relative effect per 25 yards continually diminishing.

Any officer who has, while range officer, observed closely the splash of the bullets of well adjusted shrapnel will at once recognize the agreement between the data of this curve and the actual facts. An elliptical area about 50 yards long is densely covered while scattered puffs of dust appear beyond it.

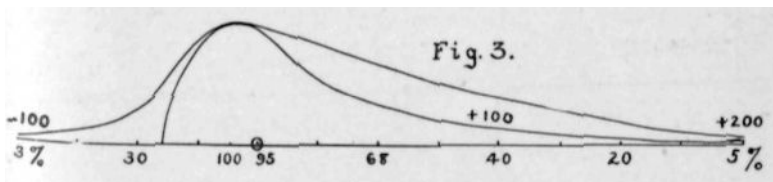
If we accept the above calculations it will then be seen that the serious effect of a single shrapnel is confined to a zone about 50 yards deep and that outside of that zone the effect is comparatively slight.

The relative effects on targets at different positions is shown by the percentages written below the line in Fig. 3.

Now if a great number of rounds were fired under field conditions with the same elevation and the same fuze setting so that the mean point of impact was at O and the mean point of burst at B, the points of burst would be dispersed both in height and in distance. The relative effect then would, at any point, be represented by the sum of the ordinates for that point, of all of the curves corresponding to the several burst points.

Actual Distribution of Effect.

The ordinates of the curve in Fig. 3 represent the relative density of hits at various points resulting from the actual firing of ten rounds of shrapnel with the same angle of elevation and the same fuze setting. For the sake of comparison of the distribution of relative effect the maximum ordinate of this curve is made equal to that of the theoretical curve for a single shrapnel and the two curves are referred to the same axes.



The relative effect, as indicated by the ordinates of the curve for points 12½ yards apart along the ground, are, for convenience of reference, placed in tabular form below opposite the corresponding distances from the center of impact.

TABLE A.

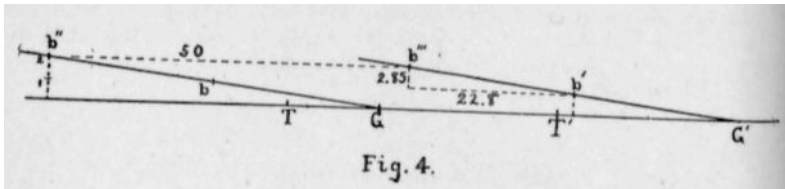
Relative effect.	%	3	7	12	19	30	49	80	100	95	87	74	61	54	47	40	34	29	24	20	16	12	6	5		
Distance of target from center of impact.	yds.	-100	-87	-75	-67	-59	-37	-25	-12	0	12	25	37	50	62	75	87	100	112	125	137	150	162	175	187	200

We are never able to state what the effect of any one shrapnel will be, but in the course of firing the average effect of all of the shrapnel fired with the same range and fuze setting will approach nearer and nearer to the mean, so that the figures in the table may be fairly assumed to represent the probable relative effect of any one shrapnel.

Compare the second curve with the first, and note that the maximum ordinate is still a little behind the center of impact; that the probable effect does not fall off so rapidly from the maximum; and that, at plus 200 yards the relative effect remains nearly as low as for the single shrapnel. We will now apply these percentages to the searching of zones of various depths.

Possible Positions of Target in a Bracket.

Suppose a zone of any depth GG' to have been bracketed with one mil bursts. Considering the angle of fall at a range of 2850 yards, the target must be between b and b', but not too near either point, or a bracketing or a mixed salvo would probably have been obtained in the ranging. For the range considered bG is about 23 yards; therefore let us assume that the target lies between T and T', which are 12½ and 25 yards respectively from G and G'.



THE 50 YARDS BRACKET.

If a 50 yard bracket has been obtained between 2800 and 2850, the effect may be considered on targets at ranges 2787½, 2800, 2812½ or 2825.

Let us compare the relative effect of different methods of fire for effect against this bracket, using the same total number of projectiles in each method,—twelve salvos,—and considering six salvos at one range as a standard for comparison. It is assumed that the effect produced by the firing at any one range is proportional to the number of projectiles fired at that range. The numbers in the following tables are taken from table A, using a proper multiplier where more or less than six salvos are fired at each range:

BRACKET 2800-2850.

1ST METHOD.

Six salvos at each range.

Ranges	Possible positions of target.				Mean probable effect.
	2787	2800	2812	2825	
2800 -----	100	95	87	80	90.5
2850 -----	19	30	49	80	44.5
	119	125	136	160	135.

2ND METHOD.*

Four salvos at each range.

Ranges	Possible positions of target.				Mean probable effect.
	2787	2800	2812	2825	
2800 -----	66.6	63.3	58.	53.3	60.3
2825 -----	32.6	53.3	66.6	63.3	54.0
2850 -----	12.6	20.	32.6	53.3	29.6
	112.	136.6	157.3	170.	144.

* Since but four instead of six salvos are fired at each range, the probable effects given in Table A must be multiplied by for use in this table in order to compare it with the first method.

3RD METHOD.

Six salvos at each range.

Ranges	Possible positions of target.				Mean probable effect.
	2787	2800	2812	2825	
2800 -----	100	95	87	80	90.5
2825 -----	49	80	100	95	81.0
	149	175	187	175	171.

4TH METHOD.

Twelve salvos at each range.

Ranges	Possible positions of target.				Mean probable effect.
	2787	2800	2812	2825	
2825 -----	98	160	200	190	162

5TH METHOD.

Twelve salvos at each range.

Ranges	Possible positions of target.				Mean probable effect.
	2787	2800	2812	2825	
2800 -----	200	190	174	160	181

We would then select the fifth method as the one which gives the greatest probable effect and also as the one requiring the least manipulation of the fire.

It may then be said that, having obtained a 50 yard bracket, fire for effect should in general be begun at the short range of the bracket. Should it be discovered during the fire for effect that all percussion bursts were short it would be an advantage to increase the range 25 yards.

THE 100 YARDS BRACKET.

Having surely bracketed a target within 100 yards, it would necessarily lie in one or the other of the 50 yards subdivisions of that bracket. As just demonstrated the best way to search for it in either of these 50 yards spaces would be by firing at the short end of the 50 yards. But since we do not know in which of the 50 yards brackets the target lies we must deduce, by the methods indicated above, the percentages for different methods of searching the whole of the 100 yards bracket. We will again use 12 salvos in order that a comparison may be made with the advantages of the 50 yards bracket.

BRACKET 2800-2900.

1ST METHOD.*

Six salvos at each range.

Ranges	Possible positions of target.								Mean probable effect.
	2787	2800	2812	2825	2837	2850	2862	2875	
2800 -----	100	95	87	80	74	68	61	54	77.0
2900 -----	0	3	7	12	19	30	49	80	25.0
	100	98	94	92	93	98	110	134	102.0

2ND METHOD.*

Four salvos at each range.

Ranges	Possible positions of target.								Mean probable effect.
	2787	2800	2812	2825	2837	2850	2862	2875	
2800 -----	66.6	63.3	58	53.3	49.3	45	40.6	36	51.6
2850 -----	12.3	20	32.6	53.3	66.6	63.6	58	53.3	45.0
2900 -----	0	2	4.6	8	12.6	20	32.6	53.3	16.6
	79.0	85.3	95.2	114.6	128.5	128.6	131.3	142.6	113.2

* Note the small effect of the fire at the long end of the bracket.

3RD METHOD.

Six salvos at each range.

Ranges	Possible positions of target.								Mean probable effect.
	2787	2800	2812	2825	2837	2850	2862	2875	
2800 -----	100	95	87	80	74	68	61	54	77.4
2850 -----	19	30	49	80	100	95	87	80	67.6
	119	125	136	160	174	163	148	134	145.0

4TH METHOD.

Twelve salvos at each range.

Ranges	Possible positions of target.								Mean probable effect.
	2787	2800	2812	2825	2837	2850	2862	2875	
2800 -----	200	190	174	160	148	136	122	108	155.0

5TH METHOD.

Six salvos at each range.

Ranges	Possible positions of target.								Mean probable effect.
	2787	2800	2812	2825	2837	2850	2862	2875	
2700 -----	47	40	34	29	24	20	16	12	27.7
2800 -----	100	95	87	80	74	68	61	54	77.3
	147	135	121	109	98	88	77	66	105.0

Consideration of the above methods indicates that a good method of beginning the attack of a 100 yards bracket is by firing at the short end of it, since it gives the greatest probable effect over the whole bracket and at the same time gives good distribution over it. If in the course of the fire for effect it appears that the target is in the farther 50 yards of the bracket the effect may be increased by raising the range 50 yards.

THE 200 YARDS BRACKET.
BRACKET 2800-3000.
1ST METHOD.*
Four salvos at each range.

Ranges	Possible positions of target.															Mean probable effect.	
	2787	2800	2812	2825	2837	2850	2862	2875	2887	2900	2912	2925	2937	2950	2967		2975
2800 -----	66.6	63.3	58.0	53.3	49.3	45.3	40.3	36.0	31.3	26.6	22.6	19.3	16.0	13.3	10.6	8.0	35.3
2900 -----	0.	2.0	4.6	8.0	12.6	20.0	32.6	53.3	66.6	63.3	58.0	53.3	49.3	45.3	40.3	36.0	33.8
3000 -----	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.0	4.6	8.0	12.6	20.0	32.6	53.3	8.3
	66.6	65.3	62.6	61.3	61.9	65.3	72.9	89.3	97.9	91.6	85.3	80.6	77.9	78.6	83.5	97.3	77.5

*Note the small effect of the fire at the long end of the bracket.

2ND METHOD.

Three salvos at each range.

Ranges	Possible positions of the target.															Mean probable effect.	
	2787	2800	2812	2825	2837	2850	2862	2875	2887	2900	2912	2925	2937	2950	2967		2975
2800 -----	50.0	47.5	43.5	40.0	37.0	34.0	30.5	27.0	23.5	20.0	17.0	14.5	12.0	10.0	8.0	6.0	26.3
2850 -----	9.5	15.0	24.5	40.0	50.0	47.5	43.5	40.0	37.0	34.0	30.5	27.0	23.5	20.0	17.0	14.5	29.6
2900 -----	0.	1.5	3.5	6.0	9.5	15.0	24.5	40.0	50.0	47.5	43.5	40.0	37.0	34.0	30.5	27.0	25.6
2950 -----	0.	0.	0.	0.	0.	1.5	3.5	6.0	9.5	15.0	24.5	40.0	50.0	47.5	43.5	40.0	17.6
	59.5	64.0	71.5	86.0	96.5	98.0	102.0	113.0	120.0	116.5	116.5	121.5	122.5	111.5	99.0	87.5	99.1

3RD METHOD.

Six salvos at each range.

Ranges	Possible positions of target.														Mean probable effect.	
	2787	2800	2812	2825	2837	2850	2862	2875	2887	2900	2912	2925	2937	2950		2962
2800	87	80	74	68	61	54	47	40	34	29	24	20	16	12	12	52.5
2900	7	12	19	30	49	80	100	95	87	80	74	68	61	54	51.1	
	100	98	94	92	93	98	110	134	147	135	121	109	98	88	77	103.6

4TH METHOD.

Four salvos at each range.

Ranges	Possible positions of target.														Mean probable effect.	
	2787	2800	2812	2825	2837	2850	2862	2875	2887	2900	2912	2925	2937	2950		2962
2700	31.3	26.3	22.6	19.3	16.0	13.3	10.6	8.0	5.3	3.3	2.6	1.0	0.6	0.3	0.	10.2
2800	66.6	63.3	58.0	53.3	49.3	45.3	40.3	36.0	31.3	26.3	22.6	19.3	16.0	13.3	10.6	35.0
2900	0	2.0	4.6	8.0	12.6	20.0	32.6	53.3	66.6	63.3	58.0	53.3	49.3	45.3	40.3	34.1
	98.0	92.0	85.3	80.6	78.0	78.6	83.6	97.3	103.3	93.0	83.3	73.6	66.0	59.0	51.0	79.3

Between the second and third methods there seems to be little choice, with a slight advantage in probable effect for the latter. Firing at two ranges only also has the advantage of simplicity. The distribution indicated by the totals in the horizontal line is good in either method.

THE 400 YARDS BRACKET.

BRACKET 2800-3000.

Three salvos at each range.

Possible position of targets.											
Ranges	2587	2600	2612	2625	2637	2650	2662	2675	2687	2700	2712
2600 -----	50	47.5	43.5	40.0	37.0	34.0	30.5	27.0	23.5	20.0	17.0
2700 -----	0	1.5	3.5	6.0	9.5	15.0	24.5	40.0	50.0	47.5	43.5
2800 -----	0	.0	.0	.0	.0	.0	.0	.0	1.5	3.5	6.0
2900 -----	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	50	49.0	47.0	46.0	46.5	49.0	55.0	67.0	75.0	71.0	66.5

Ranges	2725	2737	2750	2762	2775	2787	2800	2812	2825	2837	2850
2600 -----	14.5	12.0	10.0	8.0	6.0	4.0	2.5	2.0	1.5	1.0	0.5
2700 -----	40.0	37.0	34.0	30.5	27.0	23.5	20.0	17.0	14.5	12.0	10.0
2800 -----	9.5	15.0	24.5	40.0	50.0	47.5	43.5	40.0	37.0	34.0	30.5
2900 -----	.0	.0	.0	.0	.0	1.5	3.5	6.0	9.5	15.0	24.5
	64.0	64.0	68.5	78.5	83.0	76.5	69.5	65.0	62.5	62.0	65.5

Ranges	2862	2875	2887	2900	2912	2925	2937	2950	2962	2975	Mean probable effect.
2800 -----	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.5
2900 -----	8.0	6.0	4.0	2.5	2.0	1.5	1.0	.5	.0	.0	16.6
2800 -----	27.0	28.5	20.0	17.0	14.5	12.0	10.0	8.0	6.0	4.0	16.2
2900 -----	40.0	50.0	47.5	43.5	40.0	37.0	34.0	30.5	27.0	23.5	13.5
	75.0	79.5	71.5	63.0	56.5	50.5	45.0	39.0	33.0	27.5	60.0

As to other methods of searching the 400 yards bracket it will be seen by inspection that to take 200 yards bounds would leave much space very thinly covered, while to push through with smaller bounds than 100 yards would consume too much time and would be inconsistent with the necessity for haste implied by the use of the 400 yards bracket.

Taking a general view of all of the foregoing tables the following conclusions may be arrived at:

- 1st. That fire at the long end of any bracket is not profitable.

2nd. That 100 yards bounds suffice for opening fire against any bracket.

3rd. That a change of less than 100 yards during fire for effect should be made only when additional information as to the location of the target in the bracket is obtained during the fire for effect.

4th. Using the method which gives the best percentage for each size of bracket we see that the relative effects are as follows:

For a 400	yards	bracket	60
For a 200	"	"	103
For a 100	"	"	155
For a 50	"	"	181

using the same number of projectiles in each case. Hence it is desirable to get the smallest possible bracket if effect only is considered.

We must not, however, lose sight of the fact that some effect obtained quickly is often of greater value than more effect later on. Sometimes effect must be obtained quickly or not at all, owing to the changing vulnerability of the target, while at other times the smallness of the bracket is limited only by the facilities for observation. Therefore tactical and technical considerations both influence the decision as to when the adjustment for range is completed.

FIRE UPON GROUND SLOPING DOWN TOWARD THE FIRING BATTERY.

With a target on such ground, and a one mil height of burst with respect to the target in the ranging, the bursts at the short end of the bracket will be air bursts and those at the long end will be percussion bursts.

The manipulation of the corrector during fire for effect will then depend upon the character of the target.

For example, an immobilized target of little depth.—In this case the corrector gives 3 mils with respect to the target and should not be changed throughout the bracket; the salvos which are at the most effective range will have their proper burst point, those short of the target will be more effective than if the corrector were lowered, and those beyond the target will give percussion bursts which will be valuable indications that such ranges are too long and should be discarded.

When an area is to be searched.—The target may be in any part of the bracket and the whole bracket must be swept effectively. If the slope be not steep, that is about 4%, then the corrector which gives a 3 mil burst at the short end of the bracket must be increased 1 mil for each 100 yards increase of range; if a steep slope an increase of 2 mils is required for good effect.

It will be noted that in the bracketing of a target on such a slope the depth of the actual bracket will be less than that indicated by the sight setting used. In the case of an immobilized target this is of no consequence. In the case of moving targets the full size of the bracket will be restored automatically if direct laying is used, while, if indirect laying is used, it may be restored by increasing or decreasing the angle of site from salvo to salvo; in the latter case the corrector should not be changed.

SEARCHING BEHIND A CREST.

- 1st. When the target is a battery whose flashes are seen.
- 2nd. When the target is a battery whose flashes can not be seen.
- 3rd. When the target is other than a battery, as limbers, trains, infantry reserves, etc.

THE BATTERY WHOSE FLASHES ARE SEEN.

If the flashes of a battery are seen the distance that the guns are below the top of the crest is determined between certain limits,—namely, the height of the shield (2 yards) and the height of the flash (4 yards). In other words the target is, for medium ranges, about one mil below the crest.

If then, searching fire is begun at the known range of the crest with a corrector which will give a mean height of burst two mils above the crest, the effective range will have the proper height of burst with respect to the target and the same principles will hold in regard to searching the bracket as were enunciated above for slopes not exceeding the angle of fall of the projectiles.

If the slope is steeper than the angle of fall of the projectiles the target will be protected against the bullets of the upper nappe of the sheaf. The target must then be reached by the bullets of the lower nappe; a close adjustment of range is required, and searching with 25 yards increments of range. The target could

not on such a slope be more than a few yards in rear of the crest, (about 30 yards at a 3,000 yard range) and the use of a few ranges only would be required in searching; if the slope were not greater than the angle of fall the target would be quite vulnerable to shell fire.

DETERMINATION OF THE RANGE TO THE CREST.

If nothing is known as to the steepness of the slope it is advisable, in ranging on the crest, to use a corrector which will give zero heights of burst with respect to the crest, equivalent to 1 mil bursts with respect to the target. When the bracket on the crest has been narrowed to 100 or 50 yards fire at its longer range will furnish evidence as to the slope in rear. If the slope is steep some long bursts will be lost while with a gentle slope such burst would be on percussion not far enough below the crest to be lost. If it is suspected that the slope is steep shell fire could be used to advantage to test it, since the smoke ball of the shell is much larger than that of the shrapnel on percussion. Care must be taken not to be deceived by a battery on a reverse slope in making this test.

SUPERIOR LIMIT OF SEARCHING.

If the target is on a gentle slope (2%) behind a crest it can not be nearer than about 100 yards to the crest or the shields would be seen, while if it is more than about 250 yards from the crest the flashes would not be seen. For steeper slopes a less distance would conceal the flashes. We may therefore assume a zone not more than 300 yards deep for a battery whose flashes are seen, provided we know that it is on the slope in rear of the crest.

A battery on a reverse slope but showing its flashes would be equivalent to one on a gentle slope. If such a position were possible, however, it would, also, generally be possible to get flash defilade and this would probably be done.

When the target is much more than 300 yards behind the covering crest an observer at the firing battery may be able to see the target by gaining a slight elevation. Trees, ridges or other objects known to be behind the target furnish obvious means of limiting the searching.

BATTERY WHOSE FLASHES CAN NOT BE SEEN.

When the target is a battery with flash defilade it is a difficult matter to determine the best method of searching for it, unless some information in regard to the slope can be obtained. Sometimes a good map is available from which the probable position of the target and knowledge of the terrain about it can be derived.

It is certain, however, that a battery which has flash defilade is at least 5 yards below the crest, or at medium ranges about two mils. Therefore searching should generally be begun with a burst one mil above the crest.

As the degree of slope is never known to a certainty searching should be begun at the range of the crest. If the slope is gentle it may be searched by successive volleys varying in range by 100 yards, keeping the corrector which gives the one mil burst above the crest. This method of using the corrector is recommended for all searching behind a crest where nothing is known of the degree of slope. If the slope proves to be steep the fire will not be as effective as it would with a variation in the corrector but on the other hand if the corrector is lowered from range to range and the slope proves to be gentle the fire may be rendered totally ineffective because at the ranges which would have given effective shrapnel bursts the bursts are all on percussion.

Advantage should be taken of every means for determining the long limit of the zone to be searched, and if the exact direction of the target can not be ascertained sweeping will be necessary.

If the slope is steep it will be necessary to combine with the increase of range a decrease of the corrector.

A very steep slope would be one which was equal to the angle of fall of the projectiles at medium ranges.

In this case the target might be so close to the crest that a one mil burst at the crest would give too short a burst interval for effective distribution of the sheaf. It would be well therefore to raise the corrector one mil for the initial salvo only. Manifestly the ground will be searched in this case by lowering the corrector for successive volleys without changing the range.

If the slope is less steep it will be necessary both to lower the corrector and increase the range for successive volleys. It will then be necessary to take cognizance of the fact that the decrease of the corrector increases the range of the burst point and that

therefore 100 yards increments of the range will probably no longer be appropriate.

In order to have a good understanding of the effect of various combinations of range increments and corrector decrements and their application to different degrees of slope let us consider a few examples.

1st. Increment of range 50 yards. Decrement of corrector 1 mil. Range about 2850 yards. (See Fig. 4.)

At this range the slope of fall is about one on eight and the value of the mil is 2.85 yards. Lowering the burst 2.85 yards on the trajectory therefore moves it forward $8 \times 2.85 = 22.8$ yards which added to the 50 yards increase of range makes the new burst point 72.8 yards farther and 2.85 yards lower. A slope of is equal to 4% very nearly, therefore, these changes are suitable for a 4% slope.

Similarly, increment of range 50 yards, decrement of corrector 2 mils, gives a slope of 6% and the increased range of burst is 95 yards.

Increment of range 25 yards, decrement of corrector 2 mils, gives an 8% slope with burst points 70 yards apart.

LIMBERS, INFANTRY RESERVES AND WAGON TRAINS.

Such targets when sheltered by the terrain may be attacked in the same manner as a battery whose flashes can not be seen. They are much more vulnerable than the battery target, and liable to move, so that the area must be searched quickly and there may be little time for refinement in the manipulation of the corrector. They generally get close to the cover, and usually do not seek cover from gentle slopes, since their presence is too easily discovered there. It is therefore recommended to use against them 50 or 25 yards increments of range with two mils decrement of corrector.

Whenever the target is a battery whose flashes are not seen, limbers, infantry, reserves, trains, etc., concealed behind a crest, every endeavor should be made to get a view of it by means of scouts or auxiliary observing parties. If this can be done the expenditure of ammunition will be greatly reduced and effect more quickly obtained.

NOTES ON THE COURSE AT THE SCHOOL OF FIRE.

CAPT. W. H. BURT, 4TH FIELD ARTILLERY.

(The notes of which these are an abridgment were taken by Captain Burt this spring, for his own personal use. Since, however, the desire to learn more about the work at Fort Sill is so general throughout the Service, the JOURNAL welcomes the opportunity to publish them.)

GENERAL INFORMATION.

The quarters available for student officers at Fort Sill are poor, but comfortable enough. Quartermaster's bunks, etc., are provided. Quarters for families are doubtful. A student officers' mess is conducted, with a student officer in charge. Private servants are poor and scarce; no enlisted men of the school detachment are to be had for outside work. Horses and service equipment are available at all times, but orderlies only at regular instruction hours. Officers bring their own saddle cloths, and flat saddles if desired. Each officer is required to have a first class field glass; the Goerz Marine, 6 power, is approved, and may be purchased through the Secretary for \$40.00. The usual uniforms, except full dress, are necessary, including khaki and white. A dispatch case, battery commander's ruler, stationery, and a number of instruction books and pamphlets are issued.

COMMANDANT'S OPENING LETTER.

This is a school of practical work; while an officer must know the theory upon which execution is based, proficiency is judged by results. In conduct of fire three points are regarded as essential: (1) proper commands given in proper sequence; (2) rapidity in determination and transmission of data; (3) rapidity in correcting data after observation. Error in commands or failure to come within a very brief time limit in handling data results in an officer being placed "hors de combat" and relieved by another.

FIRST EXERCISE.

Observation and Adjustment.

Under our regulations, adjustment is normally by platoon or battery salvo, preferably the latter. For school purposes, to save ammunition, adjustment is by platoon or piece.

In correcting deflection and height of burst, as well as range, bold changes should be made, to bracket the point desired. No effort should be made to determine how much over or short a shot is; a bracket should be obtained and split until adjustment is secured. Efforts to obtain a bracket shorter than the error of the gun are useless. In changing corrector, it should be remembered that one mil change in setting is less than the error of the fuze. Besides, there is a positive error in the graduation of the corrector scale, increasing with the range up to 4,000 yards and becoming zero again at 6,000.

Each shot short or over, each error in burst or deflection, should suggest instantly the proper correction. *Fifteen seconds* is regarded as enough time to get corrected data to the guns, and the command "commence firing" should then be given instantly. The battery should be kept constantly on the jump. During direct fire there should be a distinct understanding between the battery commander and the chiefs of platoon as to correction for errors in deflection. Paragraphs 286 and 386, Drill Regulations, are a trifle at variance on this point, the former speaking of "minor changes." *All* changes of deflection should be made by platoon commanders, and this should be clearly understood.

In observation of fire, there is properly no such thing as the sense of a *salvo*; each shot must be observed.

The regulations say the height of burst can be measured, but accuracy in this is practically impossible. For school purposes bursts are classified and recorded by the symbols given below. Where the symbol is in a circle it indicates air burst.

X—impact.

B—smoke below target (as rising from behind crest behind and at same height as lowest visible part of target).

(L)—smoke masks or is masked by target; not over two mils high, regarded generally as one mil.

(N)—normal; between two and four mils high.

(H)—high; between four and six mils.

(V)—very high; over six mils.

It is impossible to regulate the corrector so that all bursts shall be at the same height.

Careful study should be made of probability tables, as the rules of fire are based on probabilities. *It is absolutely essential that the accuracy of the gun be known.*

SECOND EXERCISE.

The class assembled on high ground commanding a clear view, 7,000 yards east of Signal Mountain. Each member carried a field glass, compass, map, sketching pad and pencils, and battery commander's ruler. Information was given that the ground in front was well strewn with targets, and members were directed to make panoramic sketches identifying the surroundings with reference to some prominent point, and giving the location and character of the targets. Artistic effect is not desired; the essentials are a reference point, character and extent of targets, their direction and angular distance in mils from the reference point, and range from the sketcher's position; also notation of that position, and direction in which sketcher was looking; and last, but not least, *speed*. Time was called in twenty-one minutes: the regular time allowed an officer when proficient is five minutes.

After the sketches had been submitted, the instructor set his observing instrument upon each target in turn. It was found that the class had located only about half of them. All were extremely difficult to see for the unpracticed eye. They were of canvas, actual size and coloring.

For indicating bursts in simulated fire, the school uses a cup made of gaspipe, with a socket by which it may be attached to a pole, and a device by which a powder charge contained in it may be fired. The use of this was demonstrated to the class.

The exercise was concluded by a visit to the targets.

THIRD EXERCISE.

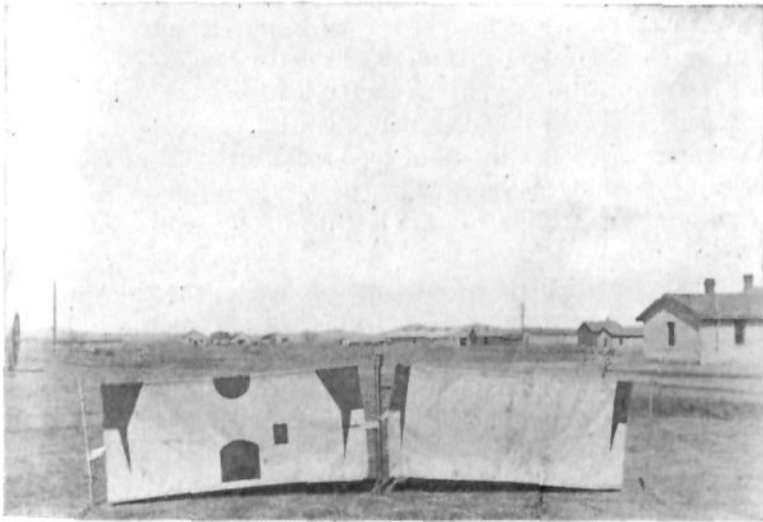
Similar to the second, except that weather conditions were very adverse. The temperature was near the freezing point, and there was a high wind and some sleet. The time allowed was fifteen minutes. Although the air was generally clear, moisture gathering on glasses made observation difficult, and the wind affected the eyes and interfered with sketching.

When sketches were finished, an exercise in simulated fire was begun. The data given by the officer representing the battery commander

were telephoned to the targets, and the officer in charge there indicated bursts by the device described above. All officers were required to observe and record the bursts, using the notation given in the first exercise.

At an afternoon session in the lecture room several paragraphs of the drill regulations were discussed.

Paragraph 288 provides that in adjustment by platoon the right platoon is usually designated. This is believed to be misleading. The matter is decided by relative visibility of the different parts of the target, and the direction of the wind, causing the smoke of the bursts to drift. The right platoon contains the directing gun, and its selection simplifies correction of deflection; but in practice there is little difficulty in using the left.



Simulated Fire Target; Gun Section, Sight Defilade (Canvas).

Paragraph 353 says that "fire at a single range is appropriate when the firing data for the enemy's position have been determined by previous fire. Thus it is adapted to the attack of all stationary targets upon which an exact adjustment has been secured or for the attack of moving targets as they reach a position upon which the fire has been previously registered." The first illustration disregards the fact that at long ranges it is practically impossible to get exact adjustment or determine the degree of exactness; it also disregards the error of the gun at such ranges. Fire between

the limits of a short bracket is surer. For a moving target a bracket should be hastily secured, and then a change made sufficiently great to allow time for communicating data, laying and firing. Galloping cavalry would go through a 400-yard bracket while these operations were being performed. A bracket for a moving target is valid only when the last shot is ahead of it. When a moving target appears the battery must get onto it at once; there is no certainty that it will come up to a point previously registered, and delay may mean the loss of an opportunity.

Paragraph 346 says, "if observation is difficult, concentration upon the most prominent part of the target is usually called for." This ignores the fact that we have no command, "by battery from the right; fire at my command." If the guns are fired separately at the captain's command he can observe shots concentrated upon a narrow space, but not if fired at regular brief intervals.

Paragraph 354 refers to fire at successive ranges. This is the usual method of fire for effect. A 100-yard bracket should be secured if possible, but this does not mean that so small a bracket is always necessary. The length of the bracket depends upon circumstances; it should be as short as practicable, enclosing all the target. For an infantry target, a bracket less than 200 yards would rarely enclose the whole of it.

With our matériel, zone fire is not profitable; the gain in speed over fire at successive ranges is not sufficient to compensate for the loss of control of fire and the large ammunition expenditure.

In fire upon a shallow target, officers often feel that they should get a 25-yard bracket; the fallacy of this is seen by considering the error of the gun. In "walking through" at successive ranges, the effect shot for shot is greater with increments of 25 yards rather than 50 yards.

When all shots of a salvo burst on impact the corrector should be raised by five rather than less. The total dispersion area in height of such a group is below the ground; probability calculations show that to be reasonably sure of a burst in the air it is necessary, at 3,000 yards, to raise the center of the group about fifteen feet.

FOURTH EXERCISE.

Practice in locating targets by panoramic sketch, as before. Snow on the ground made battery targets more distinct, but infantry less so, the dry grass and snow proving deceptive.

The afternoon was devoted to computations with probability tables, such as the following:

Determination of percentage of bursts observable with respect to a target two yards high and four wide, center of bursts being one mil high, and ball of smoke three yards in diameter. Computations made for target in the air and on level ground. Results demonstrated difficulties of observation; including all bursts, air and impact (ground target) percentages obtained were: 2000 yards, 67%; 3000, 42%; 4000, 31%; 5000, 20%; 6000, 13%.

FIFTH EXERCISE.

Field work as before; weather cloudy, causing frequent changes of light on targets; range about 3000 yards; time allowed, ten minutes.

Lecture room session devoted to probability calculations, such as the following:

1. Calculation of number of rounds percussion fire required to get a direct hit on a shielded gun; (a) with our field gun, (b) with a similar gun of one of the European nations. Battery assumed to be in open and fire accurately adjusted. Results:

Range.	2000	3000	4000	5000
Rounds for one hit (a).....	6	25	66	166
Rounds for one hit (b).....	3	10	30	-----

By a computation based on experimental firing it was found that to annihilate the personnel at one of our guns would require ninety-two shrapnel, time fire, range making little difference; this with battery in the open and fire accurately adjusted. Hence shrapnel is inefficient as compared with shell against a shielded battery. If the battery is in gun pits it is about three times as hard to put it out of action. This suggests the utility of "digging in" the battery whenever it takes position, and also of using portable shields for detached men (battery commander, telephone men, etc.), as is done in Germany.

2. Calculation of percentage of bursts on graze to be expected when center of bursts accurately adjusted at three mils; (a) for our gun, (b) for a designated European gun. Results:

Range.	2000	3000	4000	5000
Percentage graze (a).....	1.5	6.5	11.5	18.5
Percentage graze (b).....	9.5	11.5	15.	21.5

SIXTH EXERCISE.

Determination of Firing Data: Lecture Room Session.

The battery commander should, as a rule, be near his battery, so as to retain personal control.

Corrections for drift and wind are too refined for field service; the initial data are approximate anyhow. Time is the important element; targets are fleeting and must be attacked energetically at once. Omitting all unnecessary refinements and making rough calculations, deflection can be secured within twenty mils, and the second shot should be in line.

Generally the telescope should be used, for the sake of accuracy; the instrument usually has to be set up anyhow for indirect fire, to get angle of site. A quick method of relocating data for the guns is the following:—suppose observing station two battery fronts to left of directing gun; read from aiming point to right of target, then on to the left one battery front, and clamp; turn by slow motion screw on spindle until reading so clamped is again on right of target; repeat the whole process again; reading obtained (from aiming point to right of target and twice across battery front) will give deflection for right gun. For station on right of battery process is reversed;—read on right of target; clamp; turn across width of battery front on slow motion screw; read back to right on azimuth scale; repeat. The results in either case are, of course, approximate. If the first shot goes to the right throw instrument on burst, clamp, and read back to target with azimuth scale; send new reading to guns instead of command like "add five." The error in using this method depends on values of p and n ; both should be small.

In determining angle of site it is found that observers will differ by about three mils; instruments vary as much as five mils. Hence it is sufficiently accurate to give angle of site in multiples of five mils.

The Austrians have an instrument, the Baumann aiming circle, with which the battery commander has only to estimate range. The instrument will automatically compute data corrected for the guns. Many experimental instruments of this kind have been made, but this is the only one so far adopted officially. The Austrian panorama sight has two separate scales, one for deflection and one for deflection difference.

As soon as a battery takes position, the executive officer should determine and send to the battery commander the least range at which fire will clear the crest. The best way is to lay on the crest by sighting through the bottom of the bore, quadrant being set at the given angle of site, and then level quadrant bubble by the range wheel. If a battery in such a position, with minimum range to clear crest 1400 yards, should have to attack a target at shorter range, say 1200, the procedure would be to announce range as 1400, the minimum, and raise the corrector. As the maximum ordinate for 1400 yards is only 13 yards, the high burst will not matter much.

SEVENTH EXERCISE.

Field work, panoramic sketching; time fifteen minutes. Weather cold and windy. An exercise in simulated fire, using a battery and the usual communications, followed.

The lecture room session consisted of a discussion of numerous points that had come up. It was explained that "dropping back" below the short limit of the bracket was not to eliminate errors, the bracket being assumed correct, but to provide for parts of the target not being included in the bracket, as in the case of scattered infantry; it is also possible that the center of impact of shots appearing short may be actually over.

If the fifty per cent zone for a gun has been determined on the proving ground, a factor of 1.5 should be used in computations of probability, to allow for the difference between proving ground and field results.

EIGHTH EXERCISE.

Field exercise as in seventh exercise; time allowed for sketches, ten minutes. In designating targets, an observing instrument was turned upon the target, the officer was allowed to look at it, and then required to designate it to the class. Another officer was then called upon to set an instrument upon it from the description.

At the lecture room session matters pertaining to the conduct of fire were taken up. Officers are not allowed to use pencil and paper except for calculating their initial data; for all corrections they must depend upon memory. A complete record of all data is kept by an assistant, but the battery commander is not allowed to refer to it. All officers not concerned in the firing observe the

shots, and record them by means of the symbols explained above, placed in their proper position with respect to a line representing the target.

NINTH EXERCISE.

Field work as before. In the simulated fire the officer was placed in command of a battery and called upon to do all that he would do in service, only the actual firing being omitted. Among the problems arising was that of correcting distribution when, adjusting with the left platoon, the shots were found to be crossing; this of course necessitated changes both in deflection and difference, in order to have distribution correct for the whole battery.

The lecture room session was devoted to probability calculations. The problems were as follows:

Bracket 4000—4100 has been established with percussion shrapnel. (1) How many rounds required per hit at 4,000 yards, center of impact being at center of target 1.5 yards high and 4 wide? (2) Assume the target at 4000, 4025, 4050, 4075, 4100; fire five times the number of rounds necessary for one hit, at 4000, 4050 and 4100. Find the average number of hits with the target in each of the five different positions with fire at each of the three ranges. (3) Walk through the target at five ranges, number of shots found in (1) being fired at each range. Find number of hits on target in five different positions, and average through bracket. (4) Compare relative efficiency found in (2) and (3).

Results:—(1) Number of rounds per hit, 50.

(2)	Targets at					Average.
	4000	4025	4050	4075	4100	
250 rounds at						
4000	5.	4.5	3	2	.75	3.05
4050	3	4.5	5	4.5	3	4
4100	.75	2	3	4.5	5	3.05

(3)

50 rounds each at 4000,						
4025, 4050, 4075,						
4100	3.05	3.8	4	3.8	3.05	3.54

(4) The above indicates greater efficiency from firing at midrange than from walking through with same number of rounds.

TENTH EXERCISE.

The field work consisted of examination and handling of various instruments, and practice in calculation of data. Among the instruments was the German "scissors" telescope. This has two tubes, which may be set at any angle, so that it may be set up directly behind a tree; it is very quickly levelled, and angle of site measurements are independent of level; it is very portable, as it can be carried across the cantle of a saddle like a cavalry pack; and its cost is low.

The method of rough laying of the guns by prismatic compass was explained. Suppose the battery commander 200 yards to the right of his guns, and no suitable aiming point visible from both guns and station. He sets his telescope on the target and reads off the displacement reduced to mils (100 at 2000 yards) to the right of the target. On the point thus found he reads the compass bearing and sends it to the guns. The senior officer there lays the directing gun with this bearing, selects an aiming point, and thereafter the routine is as usual.

ELEVENTH EXERCISE.

Field work, panoramic sketching and simulated fire without battery.

Lecture room, discussion and critique.—When a bracket has been determined, as narrow as possible without unnecessary delay, effective fire should be brought upon it at once. In time fire it is unwarranted delay to try to get an exact range; after bracketing a "drop back" of 50 or 100 yards should be made, and the "walk through" begun. Near the target, observation is difficult, and the true sense of a shot hard to determine.

A bracketing salvo gives a range a trifle too long for effective fire. "Dropping back" eliminates the effect of faulty observation of shots near the target. In eliminating ineffective ranges, usually the first is the long range of the bracket, and the next the "drop back" range.

When the drill regulations speak of fire for adjustment and for effect, they should not be understood to mean that adjustment should be continued up to the limit of possibility and then a deliberate change made. As soon as, in the battery commander's judgment, the bracket is reasonably small, the "walk through" is commenced,

and the shots constantly observed to eliminate ineffective ranges. There should be no idea of working up to a fine adjustment, then giving a command like "volley fire five rounds" and letting everything go. Sometimes it is well to walk back after walking through, instead of beginning again at the shorter range; it may help observation.

The use of a verifying salvo will depend upon circumstances; but it is neither a line of demarcation nor a connecting link between fire for adjustment and for effect. It is merely further adjustment. When the bracket is 100 yards, a drop back of 50 is usually enough, unless there is some reason for doubt; with a 200 yard bracket, 100 yards drop back is better. Usually the walk through is in three steps, but if the bracket is 400 yards it should be by 100-yard increments. In firing at skirmishers or trenches a 200-yard bracket is usually enough, for the target has considerable depth. Going through twice with 100-yard steps is better than once with 50-yard steps, ammunition expenditure being the same.

In fire against material objects, such as a shielded battery, it is best to break down the morale of the personnel and then go at once to fire for demolition. Against infantry in trenches, if the men are up and active time fire should be used, but if they are hugging the ground, percussion shrapnel. With our ammunition changes from shrapnel to shell can not be made without readjustment.

Fire will rarely be at a single range. For example, a salvo at 2500 might give three short and one over, and at 2550 one short and three over; the center of impact of the two would be over the target. In estimating height of burst it is useful to measure the height of some object above the target, and use this as a standard of comparison.

About the worst target to attack is one in a broad depression, where perhaps an 800-yard bracket is the best that can be obtained. Only most exceptional circumstances could warrant the enormous expenditure of ammunition necessary to walk through such a bracket with any hope of effect. Sometimes a reasonable bracket might be obtained by observation from a flank; in this case it would be best for the battery commander himself to be the observer, even though this might take him a considerable distance from his battery.

In panoramic sketching the best results are obtained by sketching the outline near the bottom of the paper, a vertical line being drawn through the origin and a horizontal line across the top of the paper.

The location of targets is then indicated by verticals at the proper points, all data as to deflections, ranges, kinds of target, etc., being near the top where they cause no confusion in a hasty reading of the sketch.

TWELFTH EXERCISE.

Field work consisted of panoramic sketching and identification of targets under most adverse weather conditions. It was so cold that one had to keep constantly in motion for comfort, and a moderate fog obscured objects over 1000 yards away more or less. The targets were placed at about 3000 yards, representing batteries in direct fire position on a crest. The practiced eye could pick them up dimly with a good glass, but the average member of the class was unable to find them until their positions were indicated by flashes. Following this work was a demonstration of the possibilities and difficulties of ranging under these conditions; bursts were shown short and over, and each officer endeavored to get their sense. After practice the smoke could be vaguely distinguished from the fog; short bursts were the more readily sensed, since they caused a momentary obscuration of the dim outline of the target.

The lecture room session consisted chiefly in a discussion of the effect of shrapnel, the pattern formed by its cone of dispersion, and methods of handling it to get maximum efficiency,—interval and height of burst, etc. Methods for using the quadrant for ranges beyond that to which it is graduated were discussed; leaving the gun set at any range, say 6000, turn range reading back a certain distance, say 1000 yards, and relevel quadrant bubble by means of angle of site screw.

THIRTEENTH EXERCISE.

Field work.—Panoramic sketching, time ten minutes. Weather cold, rendering work slow; targets, however, unusually visible, the ground being covered with a continuous film of ice. Simulated fire followed; conduct of fire was difficult on account of cold and wind, obscuration of glasses by moisture from the eyes, etc.

In the lecture room the motion of the projectile after it leaves the gun was discussed, and the various causes of irregularity. An exercise was held in calling off assumed ranges for bracketing, a second person calling the sense of the salvo; the object being to

train officers to remember their bracketing ranges, and to respond quickly with the new range as soon as they know the sense of the last salvo. This exercise may be varied indefinitely, bringing in such complications as an erroneous observation.

FOURTEENTH EXERCISE.

Field work,—complete exercise in conduct of fire, all elements, including time, being introduced, but simulated bursts substituted for the actual fire. The exercise illustrated the necessity of quick decision, ready comprehension of the situation, prompt and well regulated action, and perfect team work. Each member of the battery commander's staff has to be engaged all the time upon such of his duties as will help to secure a prompt and effective fire; for example, the chief of the fifth section should be trained to compute firing data, and should start to do it as soon as his instrument is up.

The battery was placed at a distance from the battalion commander's station. An officer arrived with a message for the battery commander to report to the battalion commander for instructions, and for the battery to follow in two minutes. The instrument man, scouts, signal men and orderly accompanied the battery commander. A target was designated, and the conditions of the imaginary action explained. From this point the battery commander worked against time to get his battery into action and onto the target; any one who could not come within the time allowed was at once relieved and another officer substituted.

The lecture room work consisted of a careful and detailed critique of the morning's work, all commands, observations, etc., being placed on a blackboard and discussed.

FIFTEENTH EXERCISE.

Field work.—Intermittent rain and heavy fog obscured all objects 2000 yards away. The crest where targets were placed could occasionally be seen in outline. Officers were sent forward in turn as reconnaissance officers to prepare panoramic sketches and locate targets. The targets could be made out only by flashes, and the number of batteries had to be judged from the distribution of the flashes. Compass bearings taken from the position of the sketcher and back to the battery are of value in indicating positions of targets,

and, in fact, are about the only means under such conditions.

The lecture room session was devoted to a discussion of the determination of firing data by the parallax method, and to practice in ranging fire as described in the thirteenth exercise; one officer assumed a problem and gave the sense of shots, while another gave his commands for bracketing and subsequent fire.

SIXTEENTH EXERCISE.

Field work as in fourteenth exercise. Battery targets in the open could be identified at 3500 yards, infantry and machine guns could not be picked up. An officer conducting fire was criticized for spending time in levelling his telescope very accurately, the point being not that the instrument should not be levelled, but that it is unwarranted to spend time in adjusting after getting within the limits of other probable errors in the first shot. Change of target was introduced as an element of the work; the advantages were noted of following the method described in paragraph 272 Drill Regulations, rather than that in paragraph 245:—that is, commanding "add 100," instead of "change target" followed by new data, whenever the change is within limits which permit it.

The lecture room session included a comprehensive critique of the morning's work. Among other things, it was brought out that when one shot of a platoon salvo was clearly over or short, and the other undetermined (or two shots of a battery salvo clearly observed and the other two undetermined), there was little risk of error in using this information to fix the limit of a bracket.

SEVENTEENTH EXERCISE.

In the lecture room, a description was given of the German method of adjusting height of burst.

Fuzes are graduated in meters. On the quadrant, each point of the angle of site scale is $2\frac{1}{2}$ mils, which is equal approximately to 50 meters range. Suppose a range of 3000 meters has been given; fuze and elevation are set for 3000, and all shots burst on impact. To raise the burst, the next command is "range 2950, one higher." Range 2950 on the elevation scale and one higher on the angle of site scale gives range 3000 as before, but the fuze is now set for 2950, and the point of burst thus raised. If this gives the short limit of the bracket, the battery commander goes to 3400. Perhaps

his final command for the long limit may be "range 3200, four higher." This would seem to be a 250 meter bracket, but it is not in reality; "2950, one higher" is equivalent to 3000, and "3200, four higher" to 3400, so that the bracket is 400 meters. The system is complicated, and requires mental calculations.

Another German firing method, which has no disadvantages, was explained. When direct fire is to be used, as soon as each gun is laid the angle of site is measured and each gunner selects his own aiming point and reads his deflection to it. Thereafter all fire is by indirect method; no complications result, and fire is independent of obscuration of the target by smoke or other cause.

Reference was made to paragraph 399 of our Drill Regulations, especially to the requirement of a 25-yard bracket. Calculations of probabilities showed that, on account of the depth of the fifty per cent zone, it is practically impossible to get a reliable 25-yard bracket at 4000 yards; and that, of shots striking near the target at this range, only a comparatively small percentage are observable.

EIGHTEENTH EXERCISE.

Field work as before. Among the points taken up was a method of bracketing an obscure target by getting a sure "over" bursting on graze, so as to have the target silhouetted against the smoke.

Another point was the method to be pursued by a chief of platoon taking up the conduct of fire when the battery commander and all the men at his station had been killed. The chief of platoon probably does not know the target of the battery, and other batteries in the immediate vicinity are firing. To get the necessary information he raises his corrector very high and fires a salvo with the last announced data, thus separating his own shots from those of other batteries.

The lecture room session was devoted to a critique of the field work. It was pointed out that a burst on graze above the target is certainly over, and any burst below the target is short,—provided, of course, it is within the target area in direction.

NINETEENTH EXERCISE.

Field work as before. When sketches had been completed two officers were sent forward as reconnaissance officers to sketch ground in front which was invisible from the first position. They were

allowed five minutes to locate and sketch two targets at 1800 yards, somewhat separated and hard to see. The work was successfully done, and other members of the class were able, upon arrival, to find the targets at once by means of the sketches.

Simulated fire against one of these targets,—machine guns in position, very difficult for observation,—followed. The point was made that, with such a target, when a sure bracket has been obtained it is not wise to spend too much time trying to shorten it, but begin walking through at once to stop the damage being done by the target to our own troops.

The afternoon session was devoted to field work in preparation of firing data, principally in comparison of results by the parallax method with those obtained by the method of "parallel lines." The procedure under this latter method is as follows:

Assume the observing station eight platoon fronts to the left of the directing gun; aiming point in rear, 4000 yards. The parallax of the point is minus 5; minus 8 times minus 5 is plus 40. Set the telescope at 40 and read around to the target. The range to the target is 2000; parallax plus 10. Changing the sign of this parallax, minus 10 times minus 8 is plus 80. Read on 80 mils, and the result is the corrected reading for the gun. This, it will be seen, is simply a semi-mechanical application of the parallax method.

TWENTIETH EXERCISE.

Same as nineteenth, with variations. In the simulated fire, the necessity was demonstrated of sensing all shots at all doubtful as "undetermined." One officer, by erroneous observations, failed of getting his bracket by several hundred yards.

The following form was used for record of firing:

No. Sec.	Commands Given	No. Rds.	Range	Observations	
				At Batty	Range Party

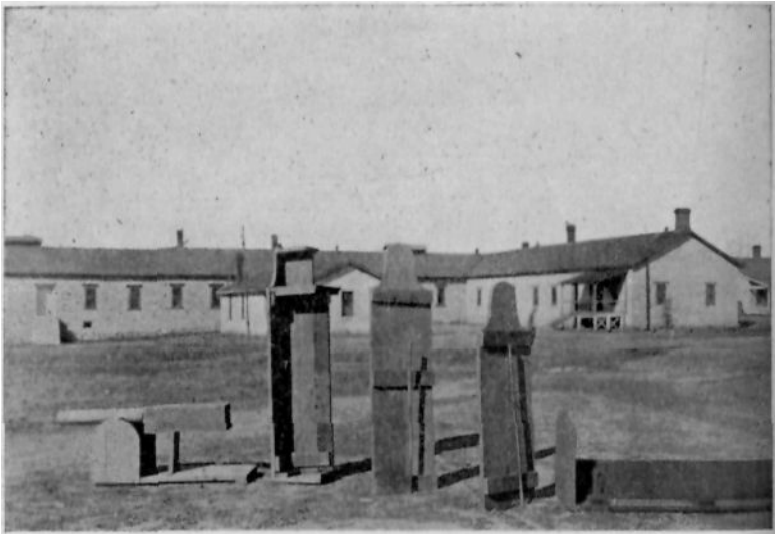
TWENTY-FIRST EXERCISE.

Same as twentieth, with slight variations.

TWENTY-SECOND EXERCISE.

Field work as usual. The following points were brought out:

If on account of the color of the target time bursts are hard to observe it may be well to change to percussion so as to get the black smoke, changing back to time fire when the bracket is obtained. If, on account of difficult observation, it is desired to adjust by converging fire, there should be a considerable interval between shots, to permit observation of each one. In walking through, the command for a succeeding range should be given immediately after the report of the guns, the time of flight being sufficient to permit this without interfering with observation of the first round. In percussion fire, if practicable, a bracket of 100 yards should be sought at 4000 yards, or 50 at 2500; but



Service Practice Targets; Machine Gun, Personnel, Standing and Prone Infantry.

the size of the bracket depends upon circumstances and the personal equation of the officer conducting the fire. All commands should be given by the voice of the battery commander if practicable; the megaphone is preferred to the telephone when it can be used. When the bracket in percussion fire grows small, if adjustment has been by less than four guns the method should be changed to battery salvos.

The lecture room session was devoted to a description of the service firing work. For record, in addition to the regular report, blue print diagrams of the targets are used for marking the hits. A hit by a shrapnel case or shell is marked by a small circle; a shrapnel

ball by a cross; a shell fragment by a cross within a circle. A non-effective hit, as where a ball strikes but does not penetrate, is marked by a small *n* above the symbol. Shrapnel ball hits on gun shields are not counted at all. Battery targets are of steel backed with wood, other targets of wood; all are constructed so as to have the same resistance as the actual target. When battery targets are used, figures representing the personnel are placed in their proper positions. Range officers' observations of overs, shorts and heights are made in mils, usually with a ruler, and then transformed and recorded in yards. Two safety officers are detailed at the guns to prevent danger to the range party. When the firing is over the range officer goes to the targets, and, if percussion fire has been used, measures the coördinates of the points of impact within 100 yards. Everything observed by the range party within 500 yards is recorded; anything beyond this is marked 500+. Chiefs of platoon keep a running account on paper of all firing data sent them, with deflection given to each of their guns.

(To be continued.)

THE FRENCH FIELD ARTILLERY DRILL REGULATIONS OF 1910.

Extracts translated for the FIELD ARTILLERY JOURNAL.

Several officers have suggested that it would be of interest to publish in the JOURNAL translations of certain parts of the new French Drill Regulations. These regulations were prepared with great care by a board of twenty officers, consisting of representatives, not only of the artillery, but also of the other arms; and they may fairly be taken to represent the present views of the French service.

Of all parts of the regulations which might be considered of interest to us, perhaps the most interesting is the Introduction, or *Rapport Justificatif*. This explains the reasons for the decisions contained in the regulations proper, and the whole work should be read in its light. In some sense, it is a confession of faith, and as such it is entitled to careful study.

All our officers are more or less familiar with the points of difference between the conservative and radical views of the handling of modern artillery. Probably none of them have been willing to follow the conservative course of the Germans, but, on the other hand, many have been unwilling to subscribe to the extreme ideas at first held by the French. How nearly right we have been may perhaps be judged by a comparison of the present French and German regulations; for both countries now possess new Field Artillery Drill Regulations, promulgated within the last year or two. Germany has at last definitely broken with her old principles, and France has receded from some of her extreme positions; the two now seem not irreconcilable. These extracts from the French Introduction will help us to comprehend her present attitude.

INTRODUCTION.

TITLE IV.—ARTILLERY INSTRUCTION.

This subject is presented in a new form, chiefly on account of the changes made in the methods of handling the matériel since

its introduction. The board that drafted the Regulations of 1903 used, as a foundation for this part of its work, the Provisional Regulations of 1898, which were the first official instructions for handling the 75 mm. gun. Its language is broad enough to cover all the methods now in use; but it is nevertheless evident that it was written with the idea of using open positions, or positions with so little defilade that the personnel, or at least the chiefs of platoon, could see the target. This is clear from the requirement that chiefs of platoon shall make the changes in direction necessary to bring the shots from their guns into their proper places in the sheaf, and also from the prescribed normal method of giving firing data. Individual and collective laying were treated as of equal importance; aiming points were generally in front, and near enough the probable target to permit deflections to be measured directly with the rule.

The increasing preference for collective laying led to much study of the problem of convergence; and the results of this were published in the Memorandum on Collective Fire, of September 25, 1903. But this study seemed unattractive to many officers, perhaps because they tried to solve the problem with too great precision; and in spite of the simplicity of the rules given in the Regulations, some sought to avoid all calculations by using other methods. Thus the favorite procedure came to be laying the directing gun roughly, and forming the sheaf by reciprocal aiming. (See Example 1, par. 439, U. S. Drill Regulations 1911.—*Translator*.) All these tendencies were favored by the tendency to draw back the guns from the crest, making it difficult to use aiming points in front.

Finally, study of the preparation of fire brought out the importance of this operation, and led to its being completed as nearly as possible before the appearance of the target. A landmark was selected within the sector where targets might reasonably be expected, and all operations performed as if this point were the right extremity of a real target. This led to increased use of the position in observation, to prepare the fire of the batteries, and "hang it up" on the battalion commander's registration point.

To mark these successive steps toward simplicity and rapidity, paragraphs were from time to time interpolated in the regulations, to the prejudice of their homogeneity and symmetry. The necessity of further amendments was foreseen, to provide for recent improvements, such as the extension of the use of sweeping, high defilade, shell fire, etc.; but these would have made the text hopelessly

chaotic. The best solution seemed to be to rewrite the whole title; in undertaking this, the board adopted the following principles:

1.—To make no changes in the service of the piece. This was necessary, in view of the instruction given the reservists of the last ten years.

2.—To separate provisions concerning the execution of fire by the personnel from those relating to its preparation and conduct by the captain. As a general rule, the personnel can merely execute orders received, without understanding their purpose or effect. It is best, then, to mark out this work precisely, omitting all unnecessary explanations, so that the commander may count on having any of his orders executed instantly, without hesitation..

3.—To place in appendices all descriptions of matériel, nomenclature, etc., which do not directly affect the handling of the guns.

Title IV, then, is divided into four parts:—an introduction, a school of the troops, a school of the battery commander, and the appendices.

Introduction.—Article 1 indicates the double purpose of the Title,—to train batteries to efficiency, and to train captains to handle them. It then explains the purpose of the different schools, emphasizing the necessity of thorough instruction of the individual cannoneer before taking up the school of the gun squad; and points out the difference between the schools of the troops and of the battery commander, the former consisting of fixed rules, the latter of suggestions.

Article 2 gives the general method of instruction. Use is to be made of every opportunity, to train the men in firing as early as possible in the instruction year; the permanent personnel, especially the officers, are to keep themselves at all times in a state of preparedness for service.

School of the Troops.—This consists of three parts,—the schools of the cannoneer, the gun squad, and the firing battery.

In the school of the cannoneer, the changes from the old regulations are slight. A few simplifications have been made, and certain additions, necessitated by modifications in matériel, or to permit special kinds of fire. Thus, provision is made for pointing by shifting the trail, and for measuring traverse in turns of the handwheel, both of which expedients are already in general use; and giving elevation by the quadrant is treated as the normal case, using the sights for the purpose being exceptional.

In the school of the gun squad there have been included those paragraphs, formerly found in the school of the battery mounted, explaining how to mount and dismount the cannoneers, these movements being usually taught at standing gun drill. An addition has been made to the paragraph describing the posts of the cannoneers in firing, providing that they shall take such positions as give the best protection consistent with the performance of their duties. This was done to counteract the notion that the personnel of a battery under fire should cease firing and take cover behind the shields. The command "take cover" is reserved for the captain, and is intended for a different purpose, as explained in the school of the firing battery.

The movements of the gun squad, necessary to enable the captain to prepare the fire, determine the minimum elevation, modify distribution, etc., are described as briefly as possible; so also are the movements required in positions in observation, as described below. The command "note deflections" is substituted for the command "in observation," in cases where the two mean the same thing.

The mechanism of the different kinds of fire is briefly described, including volleys at a single range and zone fire, although these terms are not used in this part of the regulations; these kinds of fire are described both without sweeping, and with single and double sweeping. Other special cases are explained, such as individual laying with the collimator; laying on a moving target by shifting the trail, which is particularly applicable in horse batteries, and for firing upon dirigible balloons; fire at will, in which corrector and range are not specified in the commands; and fire at the command of the chiefs of section, according to the instructions of the battery commander.

The school of the firing battery is very brief. It begins by describing the posts and duties of the personnel; it places the immediate control of the battery in action in the hands of the active lieutenant, so that, when the captain leaves the battery, the command is always assured without calling upon the chiefs of platoon.

Nothing is included here but the description of the commands and means for preparing, opening and directing the fire; all discussion and explanation is carried over into the school of the battery commander.

School of the Battery Commander.—As explained above, this part of the regulations is written in a totally different spirit. It is intended as a guide to the battery commander in solving the problems that he will encounter, from the time he receives orders to go into action. Hence it contains few absolute requirements, but many suggestions; it proposes at least one solution for each problem, but does not insist upon its acceptance. The technical operations involved in the preparation and execution of fire depend upon the skill and experience of the captain, the degree of haste required in the particular case, and the action of the enemy. There can be no absolute rules, no general solutions adaptable to all circumstances, but only suggestions; the battery commander, in each case, must use his ingenuity and his judgment.

The chapters of this school deal respectively with the different operations to be performed by the battery commander in getting his battery into action.

First comes *selection of position*. Here comes in the problem of masked fire; many methods of solving this have been suggested, but none of them is entirely satisfactory. The text adopted is an effort to get back to first principles, which have sometimes been forgotten,—that is, to point out that when the guns are not unusually distant from the mask, a sufficiently accurate solution consists in determining whether, the piece being correctly laid, its axis prolonged passes above the mask. This is done by comparing two angles; the elevation of the piece depends on the range tables, which should be familiar to the battery commander, and the angle of site of the top of the mask can be measured or estimated on the ground. This simple solution seemed better adapted to the purposes of the regulations than any of those depending on approximate equation of the trajectory, or on formulæ whose demonstration could not properly be included in the text, and which therefore would have to appeal to the memory only.

The next article deals with *preparation of fire*. It was necessary here to discuss the formation of the sheaf of fire, and to cover the same ground as the memorandum of September 25, 1903, on collective fire. But theoretical treatment of the differences of parallax, and convergence corrections, were considered out of place in the regulations; and the properties of aiming points, which should be familiar to all non-commissioned officers, have been treated graphically, by means of diagrams to scale, showing a battery in position

at normal interval, firing upon a target of moderate front at medium battle range.

A careful study of the diagrams and descriptive text will make clear the application of the principles of convergence and distribution to the problem in hand; also, to a reader who is not concerned with theory, it will show the methods of determining quickly, for any position of the aiming point, the deflection and difference to be used under average conditions. It will then not be difficult to make such modifications in distribution as may be made necessary by a change in the front of the target or of the battery.

Some details are also given here concerning formation of the sheaf by successive operations; as, for instance, when no aiming point is used, but the directing gun is put on the target by some simple means of marking the line of fire, which may sometimes be done even before the battery reaches the position. In such a case the work becomes very simple, and no computations need be made either by the captain or any subordinate.

The chapter on *execution of fire* repeats the familiar requirements concerning observation and adjustment, and also introduces certain new matter which requires special notice.

Anchoring pieces.—Instead of following the 1903 regulations, it is prescribed that, upon the appearance of a target, the first salvo shall be fired with an open sheaf, having a distribution difference of 15 or 25 mils, and the front of the sheaf adapted to that of the target afterwards. This is to permit freer use of the traverse on the carriage, to cover the maximum front without shifting the trail. It can readily be demonstrated that, assuming a distribution difference of 20 mils, and a possible traverse of 40 mils on each side of the normal, a battery can cover 140 mils, or 350 meters at a range of 2,500; at the same time the sheaf can be concentrated upon a target only 20 mils wide. If the old rule were followed, and the sheaf contracted to 20 mils before anchoring, the maximum front covered could be only 100 mils, or 250 meters at 2,500.

Positions in observation.—*Observation* is the situation of a battery which has no target for the time being,—its old target having disappeared, or none having yet appeared. Here a deflection is recorded which is calculated to bring the directing gun upon a registration point selected by the battery commander,—a fictitious target in place of a real one, so that when a target does appear the battery can change to it easily.

When a target disappears, or it is no longer necessary to fire at it, the battery may return to observation, taking its old registration point, or a new one better situated; in the latter case the operation is treated as another change of target, and the new deflection noted. If the fire of the battery is divided between two targets, or the sheaf becomes irregular for any reason, the captain can quickly straighten things out again by returning to his registration point.

In general, changes from one target to another will be made directly, without first returning to the registration point. If, however, the new target is described with reference to that point, the change may be made by two successive modifications in direction.

Properties of the trajectory.—The relations existing between angle of site, corrector and range were mentioned in a fragmentary manner in the regulations of 1903, but the practical use to be made of them was not explained. A knowledge of them is indispensable in firing upon a deep target placed on a slope, or if it is desired to have the projectiles burst at a given point in the trajectory.

In these regulations all matter relating to this subject has been collected in one place; a new term, "range of burst," has been introduced, meaning the distance from the gun to the point of burst; and the principal applications have been pointed out.

One of the subjects treated here is firing into the dead space by raising the point of burst. This idea has been much discussed; it is very inviting in theory, and if its actual effect is good it solves the problem of masked fire. But experiments have shown, as might have been expected, that the effect decreases rapidly as the point of burst is raised. The board therefore thought it necessary to point out the limits within which this kind of fire can be usefully employed. The raising of the point of burst can be accomplished by means of the corrector, and no new commands are necessary.

Mechanism and rules of fire for effect.—The process of sweeping, single or double, with a variable number of projectiles, now so familiar to all, has been retained, by reason of its simplicity and convenience, and the complete control it gives of the density of fire.

A modification has been made in zone fire. In the regulations of 1903, this procedure was placed first in the list of kinds of fire, and illustrated in most of the examples given, so that it was used perhaps too frequently by battery commanders. Its effect is to distribute 32 or 48 projectiles over a zone 450 meters deep in less than

a minute; and it is intended for use in two different cases. The first is, against a deep target, where all four volleys may be expected to be effective; the other is, against a relatively shallow target, very important and very transitory, where there is no time for accurate ranging.

In the first case, all parts of the target must be on the same level, or else the heights of burst and hence the effect will vary greatly. This will rarely be the case; and, since a deep target can hardly be a very transitory one, effect seems to come before rapidity, so volleys at successive ranges seem more suitable.

In the second case, it is known beforehand that only one or two of the four volleys will be effective. Rapidity is here the main consideration, and this is the case where zone fire may properly be employed. To retain the characteristic of rapidity, the board has prescribed that, if adjustment is made on the target itself, the 400 meter bracket only be sought. Then, to minimize the number of volleys, the short limit of the bracket is taken as the initial range. It is not considered necessary to reduce this by 100 meters, as formerly prescribed. This extra 100 meters was taken to avoid the possibility of mistaking an "over" salvo for a "short" because the bursts happen to be high; but the wider the bracket the less chance there is of this, and in any case it is less likely to happen with a salvo than with a single shot. And if, in adjustment, the captain gets a mixed salvo, part over and part short, he will not use zone fire at all.

Another reason for this 100 meters reduction was to reach a target advancing toward the battery. But if the bracket is only 400 meters, the target is not likely to pass the short limit before the fire for effect begins; and, if the captain has the least doubt, it will in any case be advisable to verify his short limit before passing to zone fire.

In addition to the regular kinds of fire, the board has provided a very flexible one, in which the captain can give each gun a separate front, range, and speed of fire, leaving the chiefs of section to manage their pieces; the captain then observes the fire of all, and modifies the details according to circumstances.

The next chapter deals with the *conduct of fire*. It points out first that the useful effect of a battery is not always measured by the actual effect of its projectiles, and that elements not strictly technical must often affect the conduct of fire. Effectiveness depends

upon the vulnerability of the target, and this varies constantly with its range, form and mobility. The means of reaching it must therefore vary; and hence every case of fire is a special case.

The general principles of conduct of fire are laid down; but examples are omitted, for the natural tendency is to try to fit each particular case that arises to some one of the examples in the regulations, instead of treating it on its merits. The examples given in the 1903 regulations no longer covered the ground; there was a growing demand for more of them. But the board realized that no matter how many were given the series would always be incomplete, so discarded examples altogether and substituted a detailed discussion of all targets that are likely to confront artillery in the field. Only in a few special cases, such as dirigible balloons and aeroplanes, have special methods of fire been indicated.

The last chapter deals with the *battery in battalion*. Here is treated the matter of fire direction by the battalion commander. The regulations of 1903 devoted only two paragraphs to this; the general idea was that the battalion commander, "stationed near the center," would be able to direct the fire by giving "a simple angular distance referred to his registration point."

Such a centralization may be in order where several battalions are in line in a cramped position; the difficulty of executing the fire may be greater, but those of command will be less. But often the batteries can be distributed more or less, and some will be too far away to be handled in this manner. Hence these regulations have sought to provide for more independent action of the battery commanders in case of need.

Supervision and control of the fire of his batteries is the principal function of the battalion commander; he has also to see that steps are taken to conform to the tactical situation. If he has occasion to indicate targets by angular distance from a registration point, he will of course have to transform his angles for the position of the batteries; means for doing this are provided here.

TITLE V.—ARTILLERY IN ACTION.

This title has been entirely rewritten; not that the principles laid down in the 1903 regulations no longer hold, but that it was thought best to emphasize certain ones more strongly, and to deduce them from a more complete analysis of the characteristics

of the matériel. The principles having been deduced, their application to both offensive and defensive action is shown; and finally rules are given to guide artillery commanders of all grades in operations peculiar to the arm, and in maneuvering batteries within the combat zone.

After an introduction devoted to generalities, the title is divided into three chapters: (1) Properties of artillery, and their tactical consequences; (2) Use of artillery in action; (3) Command and interior economy of artillery on the battle field.

Properties of artillery, and their tactical consequences.—The 75 mm. gun has been in service over ten years, and its properties are thoroughly familiar. Certain of them, such as the effect of shrapnel on personnel under cover, were overestimated at first; others, such as the use of collective fire from concealed batteries, were imperfectly appreciated.

The characteristic properties fall into two classes, advantageous and the contrary. In the first class we may mention range, power, suddenness of action, and ability to stand hard usage; in the second, lack of defensive power against flank or rear attack, and vulnerability when exposed. The latter class, of course, is in no way peculiar to the 75 mm. gun.

The tactical consequences are derived from the positive and negative characteristics, not only of our own matériel, but of that of the enemy. The problem now is not the same as it was in 1900, when we were better armed than any enemy, and no special effort had to be made to get every particle of advantage out of the guns; all powers have followed the lead of the French artillery, and have availed themselves of our experience. And the discussions consequent upon the Russo-Japanese War, although neither party had rapid fire guns, have brought up many problems concerning positions, defilade, and firing methods.

All these circumstances, together with increased familiarity with the new matériel and experience in its use, have of late years brought the masked position into constantly growing favor. It has become well recognized that, without losing any of its offensive power, artillery can by its use avoid the danger of destruction, and preserve its liberty of action even after opening fire. There was hardly a suggestion of this in the 1903 regulations; but these principles are now so thoroughly accepted that they deserve the

place of honor in the new edition. The first principle, then, which the board deduces from the characteristics of two opposing forces of rapid fire artillery, is that

Masked positions are to be preferred. This being admitted, certain others follow as corollaries; some of these, in other forms, were incorporated in the 1903 regulations.

Thus, if two opposing forces of artillery use, in whole or in part, masked positions, neither of them can destroy its adversary. Hence

An artillery duel will generally be indecisive. However, as in the past, it is still desirable for artillery to secure and preserve the superiority over its opponent; not for the purpose of engaging in an independent duel, but in the interest of the whole force.

It is still as necessary as ever that due preparation be made for coming into action, so that fire for effect may be taken up at the earliest possible moment. But since artillery in a masked position is invisible to the enemy, the preparation should be extended to include the actual occupation of the position. Hence

Priority of occupation of position is a distinct advantage. As many batteries as possible should be allowed to get this advantage; but it would be a misapplication of the principle to put all the available artillery in position as soon as contact with the enemy is gained, for this might easily lead to a premature and erroneous deployment. As the 1903 regulations say, "the application of this principle is a matter of judgment; it depends upon the situation, the intentions of the commander, and the forces at his disposal." It depends also upon the terrain; and it is certainly better to keep batteries in readiness, limbered, than to crowd them into an unsuitable position.

Of the batteries in position, only such number should fire as conditions require. The 1903 regulations laid down this principle in a somewhat different form, saying that the number of batteries to fire depended in general upon the extent of front to be covered. It was thought best here to mention other points to be considered, such as the nature of the target. It will often be desirable to give a battery a broad front to cover, using to the full extent its traverse on the carriage. And, on the other hand, while it is true that if a battery is firing upon a narrow front, putting additional batteries upon the same target will not proportionately increase the effect, still the idea of putting more than one battery upon the

same target should not be entirely discarded, since, for example, oblique fire has its maximum effect only when combined with frontal fire.

These are the essential principles deduced from the characteristics of the matériel. They are all found, more or less fully developed, in the old regulations. In applying them, the board has modified the somewhat rigid rule which prescribed that fire should be by rafales, and intermittent. Artillery targets, and the effects it may produce upon them, are so varied, that it seemed better to permit fire to be either *rapid or slow, continuous or intermittent*. *Firing over friendly troops* has also been discussed, as the natural procedure in view of the characteristics of artillery fire.

Use of artillery in action.—In this chapter the principles laid down in Chapter I are applied to the two principal forms of battle, offensive and defensive, and the treatment of the two forms has been extended to their logical conclusions, pursuit and retreat.

It may be suggested that so full a description is unnecessary; that it is sufficient to follow the plan of the 1903 regulations and the Field Service Regulations,—mention the chief phases of the action and the mode of action of the artillery in each. But the board did not adopt this course, for the following reasons.

The action of the artillery itself is much the same in all phases; the differences appear only by considering its relations to the other arms, and are frequently not known by subordinates. A battery commander, for instance, who is given a target, may look upon all distinctions as purely theoretical; he sees his target and fires at it, and that is all he can think of under the excitement of the moment.

But if the commander of the whole force is to get any results, he must have made a plan of battle. He has weakened or strengthened the troop units under him, and assigned them specific duties; they are intended to meet different conditions, and to display different qualities,—mobility or activity in the advance guard engagement, tenacity and economy of force in the frontal action, violence and prodigality of force in the assault. In a word, troops must be used in different ways at different stages of the action; artillery can be no exception to the rule. It was thought necessary to point out all these peculiarities, and the most natural way to do this seemed to be to describe first an offensive, then a defensive, action.

The question may now arise, whether this distinction is necessary.

A battle will rarely assume the theoretical form, and may there not be danger of misleading the reader?

The board of course recognized that no battle would follow this smooth, well-ordered course, from the advance guard engagement to the retreat and pursuit. Where the fighting front is several kilometers long, and thousands of men are engaged in a hundred episodes at once, everything will seem to be disorder and confusion; in the course of the battle, the same troops will pass from a bold and confident offensive to a weak and passive defensive. But nevertheless if we try to determine what is taking place at a given moment in some definite part of the field, we shall in general find one party on the offensive and the other on the defensive. Hence it has been most justly said, that battle is the combination of offensive and defensive acts, in varying proportion.

It is, then, perfectly logical to describe these two forms of combat separately; and this gives the opportunity of pointing out the difference in the attitude of the artillery in the two. On the offensive, it should work in close actual *connection* with the infantry, taking as its targets the objects of attack; on the defensive, it should *co-operate* with the infantry, assisting it to break down the offensive spirit of the enemy.

One objection still remains to be answered. Instead of considering the battle as a whole, instead of introducing a course in tactics into the drill regulations, would it not have been sufficient to treat one single limited sector of the field, in which an attack or a defense is being illustrated? In this limited space, all the elements might have been studied in detail, the principles deduced, their application shown, and rules of conduct formulated; and this in the last analysis is the purpose of the regulations.

But if we carry too far the process of dividing the field into separate sectors, we are likely to forget that the events in each part of the front have their effect on those in the adjoining parts. Might not such influence extend ultimately along the whole line and decide victory or defeat?

For artillery, especially, it is dangerous to carry the subdivision too far, for we thus lose sight of one of the principal characteristics of the arm,—long range, and the consequent facility of getting oblique fire. It will not do to forget that in supporting an infantry attack, artillery must fire not only upon the front to be attacked, but also upon all hostile troops whose fire may reach the attackers,

—all the infantry within say 1000 meters, and all the artillery within 4000 or 5000. To get a conception of the employment of artillery, it is necessary to indicate the scale of the whole battle, the complexity of the whole operation, the interdependence of the separate actions, and the possible effect, upon a given attack, of thousands of rifles and hundreds of guns, spread over kilometers of front.

The purpose of the theoretical discussions of Chapter 11 is indicated by the arrangement of the text which places immediately after them a review of the duties of commanding officers of various grades. Thus, after the paragraphs on attack, comes a description of the duties of the commander of the troops and the senior artillery officers,—that is, of those who handle the *arm* itself as a tactical force; and finally of the subordinates, of whatever grade, whose duty it is to handle its *fire*. The same course is followed in treating the defense. The two subjects being brought close together, the similarities and differences are both shown clearly.

Command and interior economy on the battlefield.—In the course of any engagement, artillery commanding officers of all grades are called upon to perform certain technical operations peculiar to the arm, in order to carry out the intentions of the commanding officer of the force. In this they are assisted by subordinates, commissioned and enlisted. The purpose of Chapter III is to point out the principles that should guide all the personnel in accomplishing the more important of these tasks,—reconnaissance, marches of approach, establishment and maintenance of communications, service of security, etc. These principles were all laid down in the 1903 regulations, and have stood the test of several years of service; they are reproduced here, changed in their order only, and need no justification.

One question, however, requires special attention,—the details of command on the battlefield, due to the recent modifications in organization.

Little change has been made in the duties of the general commanding the artillery of an army corps. Besides his general duties,—and ammunition supply is one of the most important,—he will frequently act as a tactical chief of artillery, either for the corps commander when part of the divisional artillery has been attached to the corps artillery, or for a division commander in the more frequent case when all or part of the corps artillery regiment

reinforces the divisional artillery. Having direct command of the ammunition columns and the corps artillery regiment, the general is able to fulfil both of these duties.

The duty of a colonel commanding a divisional artillery regiment is easily defined; he is chief of artillery for the division. At times, however, he comes under the direct orders of the general commanding the artillery of the corps, who assumes the duty of divisional chief of artillery when the amount of artillery attached to the division greatly exceeds a regiment.

The colonel of the corps artillery regiment will only occasionally act as chief of artillery, and is usually under the orders of the artillery brigadier, with the whole or the larger part of his regiment. When, by exception, the corps artillery is equally divided between the two divisions,—which would imply that the missions of the two were of precisely equal importance,—the duty of the colonel is not evident, and special orders would be necessary to determine it. This is not an oversight, but results from the nature of the case; for under such circumstances the corps artillery has, for the time being, no reason for existence.

The lieutenant colonels of the regiments will remain with them in action, assure the execution of the colonel's orders, and attend to local ammunition supply. Their presence enables the colonels to remain with the commander of the troops as chiefs of artillery.

Throughout the Title on combat, effort has been made to avoid special terminology, and, so far as possible, to make terms correspond with those used in the Infantry Drill Regulations. This was done, not because the board did not approve the ideas implied by certain special terms, but because such terms often acquire a false meaning in current use, and lead to false results.

An instance of this is found in the words "infantry battery" and "counter-battery," which were used in the 1903 regulations in discussing the special case in a decisive attack, where the number of batteries in action permits of specializing them. This sense has been extended to all parts of the action, even the preliminary stages; so that officers have even at times classified the batteries before they had any distinct orders. Terms of this character are very useful in technical discussions, and officers will undoubtedly continue to use them; but in so doing it is important to define their meaning accurately.

THE DEPORT FIELD GUN IN ITALY.

As reported in the FIELD ARTILLERY JOURNAL for March, the Deport gun there described has recently been subjected to exhaustive tests in Italy. Since it is reported in the Paris "Temps," of April 1st, that the Italian Government has given an order for 100 batteries of these guns, some details of the tests will be of interest.

A foreign correspondent of the JOURNAL writes that three complete batteries took part in the tests,—one Deport, one Krupp and one Schneider. All were manned, horsed, maneuvered and fired by the Italians themselves. The experiments lasted for two months, and were followed, not only by the board conducting them, but also by the Chiefs of Ordnance, Field Artillery, Mountain Artillery, and Coast Artillery, the Inspector General of Artillery, several corps commanders, and, for a time, by the Duke of Aosta.

The tests were more extensive and severe than usual. There were trials at Turin, after which the guns were taken on a thirty day march over the mountains to Pisa, the worst sort of mountain roads being used, often necessitating doubling the teams. On one occasion, two pairs were taken from one of the Deport guns and hitched to the one in front; the cannoneers neglecting to set the brakes or check the wheels, the gun started down hill, taking the wheel pair with it, and rolled 300 feet down a precipice. The men were on foot, and escaped, but the horses were killed. The gun had its wheels and half the trail smashed, and some other injuries, but its essential parts were not injured, and, after new wheels and trail had been put on in the shops the piece continued through the other tests.

After the road test the guns were all tried out for accuracy, and subjected to the firing usual in such competitions. They were then taken into an open, desolate country, and subjected to a test which the board considered necessary in view of the service often required of batteries in Manchuria. This was for each gun to fire 500 rounds under battle conditions in six hours. Targets were scattered over a wide field, and changes made in range and deflection as in actual combat. Once on a target, a series of rapid volleys would be fired, fire then shifted to another target, and

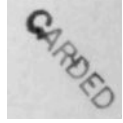
so on until the 500 rounds were finished. This test seems to have been especially devised to bring out the qualities of the Deport system, as maximum traverse had to be used.

The Krupp battery completed the test successfully in the main, but a certain amount of liquid had to be removed from the cylinder when the system became heated. There was frequent failure to return to battery, by from seven to ten inches, and some irregularity in aiming in consequence.

Only one of the Schneider guns finished the 500 rounds, and its recoil system was much overheated; liquid was leaking from the joints and the mechanism considerably damaged. The other three guns of this battery ceased firing between the 200th and 400th rounds.

All four of the Deport guns fired the 500 rounds in the six hours without derangement of the recoil mechanism and without adjusting the amount of liquid in the cylinders. This was considered to be due to the fact that, as explained in the March JOURNAL, the gun has two recoil brakes, which diminishes the heating, and that the main brake, the longer one, is well separated from the piece. Further, the Deport gun has a reservoir which, when the system is hot, receives the excess of liquid; as it cools down and the liquid in the cylinder contracts, the amount necessary to fill it flows automatically from the reservoir.

In addition to these three batteries, one gun of each make was purchased, and subjected to a test to extremity, 2,200 rounds being fired under the usual conditions of such tests. It appears that all stood this test very satisfactorily.



THE DEPORT MOUNTAIN GUN.

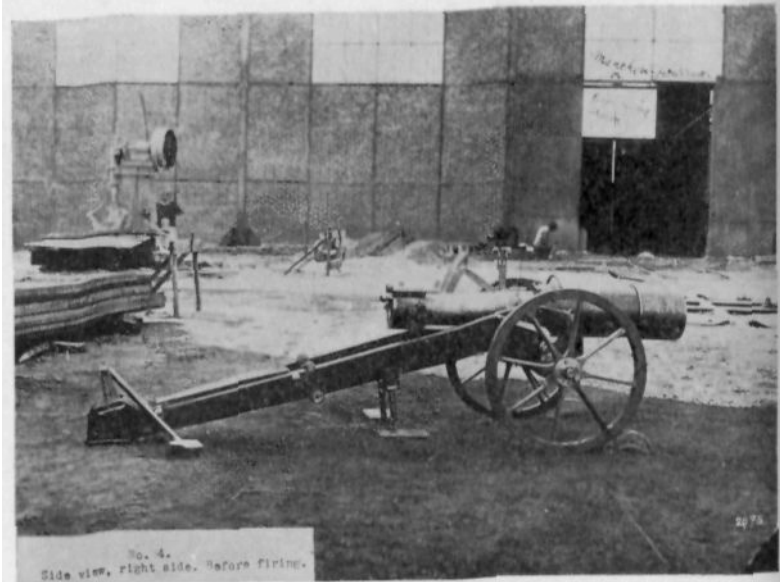
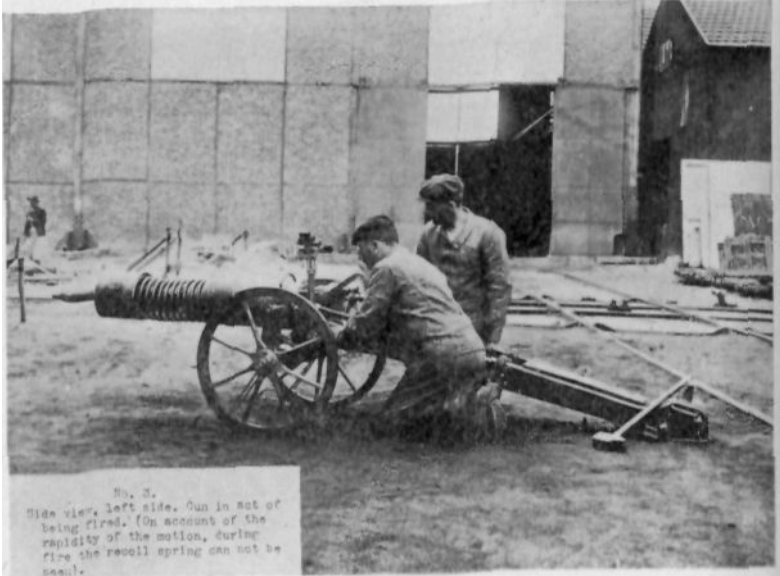
The JOURNAL presents in this issue illustrations of the new Deport mountain gun. The principle on which this gun works is familiar to our officers, but illustrations and descriptions have not hitherto been published in this country.

When the gun is placed in position it is drawn from battery, where it is held. When loaded and ready to fire, it is released. The gun returns to battery, and at the instant it reaches its highest velocity a hammer strikes the primer and fires it. The energy of recoil is thus diminished by the energy of counter-recoil, so that a relatively weak spring checks what remains.

The gun may be loaded at any elevation up to 30° , and fired at any angle from -10° to $+45^{\circ}$. Traverse is on the axle. The recoil mechanism consists almost solely of a spring; there is no oil or air cylinder. Various safety devices provide against premature fire or premature running into battery. A miss-fire can occur only with a defective primer; when it occurs a buffer takes the shock, and the only harm is that a delay ensues before the gun can be again prepared for firing.

The trail has a large surface resting flat on the ground. The sliding spade is driven down with a sledge, and the gun is firmly anchored. The two cannoneers on each side of the piece kneel on padded steps bolted to the trail; their weight helps in holding the gun steady at low elevations.

If this gun will stand service as well as its tests up to date indicate, it does much to help in the solution of the mountain gun problem. Lightness and simplicity are of prime importance in mountain artillery, and this gun in battery, without shields, weights only 715 pounds,—with shields, 836 pounds. The caliber of the gun illustrated is only 2.56", and the projectile weight only 10 pounds; a 3" gun of the same type is made, but weights for this are not at hand. The 2.56" gun and carriage are packed on three mules, the shields, tools, etc., on a fourth; the heaviest net load is 243 pounds.



The Deport Mountain Gun.

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.

JANUARY.

Training Class. January 3-14, ¾ hours per day; 15-31, one hour per day.

3. In hall. Longed 15 minutes; work-out at trot, both hands; "haunches right (left)" at walk.
4. In hall. Longed 10 minutes; work-out at trot; suppling haunches at siow trot.
5. In hall. Longed thoroughly; work-out at trot, both hands.
6. In hall. Work-out at trot, both hands.
8. In hall. Longed 5 minutes; work-out at trot at will; by threes by flank down center; on forehand half turn in reverse; on right into line; suppling haunches; individually on two tracks right and left oblique.
9. In hall. Longed 10 minutes. Drill at slow trot; at will 10 minutes; in column, change hands through half the hall at slow trot, swing haunches right or left, and come on track by "two tracks."
11. In hall. Work-out at trot, both hands. Drill slow trot, half turns in reverse, individual circles, spirals, serpentines.
12. In hall. Longed 15 minutes. Work-out, jog trot, both hands.
13. In hall. Same as 11.
15. In hall. Work-out, both hands. Haunch exercises individually; drill in column, slow trot.
16. In hall. Drill, slow trot; gallop at will, both hands; individually, haunches right and left, two tracks right and left oblique.
17. In hall. Work-out, gallop, both hands; at will 15 minutes; drill in column, haunches right and left, and two tracks.
18. Work-out at trot; gallop both hands; at will 15 minutes; drill in two track exercises and circles.
19. In hall. At will 15 minutes; individual work, asking greater collection and approaching school trot.
20. In hall. Work-out at trot 15 minutes at will; general exercises.
22. In hall. Work-out at trot; canter, both hands; at will 20 minutes; individually, vertical and lateral flexions; drill in column, demanding greater collection.
23. In hall. On track in column, troopers front to rear and rear to front; 20 minutes at will; drill, circles, haunches right and left, two tracks, on right or left into line.
24. In hall. Work-out at trot; 20 minutes at will; in column, first rider from slow trot to canter, circle in each end of hall and close on rear of column; haunch exercises.
25. In hall. Work-out at trot; short extended trot on each hand; 20 minutes at will; individually trot, slow trot, school trot, trot and halt; from head of column take canter, extend to gallop, and resume canter on circle at end of hall.
26. Road work, walk in pairs.
27. In hall. Work-out at trot and canter; drill by platoons; canter in column on circles.
29. In hall. Work-out at trot; 20 minutes at will; haunches right and left, school trot, at will, canter and make small circles, both hands; drill in column.

30. In hall. Work-out at trot; canter, small circles; 20 minutes at will; individually, haunches right and left, lateral flexions; short drill.
31. In hall, at trot. Canter at will, small circles at designated points; 20 minutes at will; individually, lateral flexions at school trot; developing canter from school trot.

School Class. January 1-14, ¾ hours per day; 15-31, one hour per day.

3. In hall. Work-out at will 5 minutes, walk and trot, both hands; trot and gallop on track, both hands; troopers front to rear; half turns in reverse; individual circles and serpentines; gallop around track and join rear of column; by threes, halt, slow trot, trot, extended trot, and the reverse.
4. Review of 3.
5. Review of 3.
6. In hall. Walk and trot, both hands; by flank, individual about, spirals and serpentines. Taking gallop on large circles, both hands. Platoon galloping on large circle, individuals leave circle and take large circle at other end of hall. Individuals from front to rear, passing around hall at gallop. Changing gaits. Haunches in.
8. In hall. Work-out, both hands, walk and trot, 5 minutes. Trot and gallop on large circles; spirals, serpentines, etc. Individual gallop around track from head to rear; halting on inner track; explanation of backing.
9. Same as 8.
10. Same as 9. About, oblique on two tracks.
11. Same as 10.
12. Same as 10.
13. Same as 10. About at gallop; on forehand to right or left, at halt.
15. In hall. Work-out at will, walk and trot, both hands. Serpentines and spirals. Gallop on large circles and on track; by flank at trot and gallop; individuals halting on inside track and rejoining column. Haunches in; putting loose horses through chute with low jumps.
16. Same as 15, but no jumping.
17. Same as 16.
18. In hall. Work-out, circles, etc., as usual. Haunches in and out at school trot. On forehand to right and left at halt. Backing. Taking gallop while on straight line. Horses without riders through chute with 3 foot jump.
19. Same as 18, but no jumping.
20. Same as 19.
22. Same as 18. Special attention to riding straight line with application of proper aids, and to taking gallop on executing about.
23. Same as 22, but no jumping.
24. In hall half hour; walk, trot and gallop on small and large circles, by flank, straight lines, backing, on forehand to right or left. One jump, 3' 8", with riders. Outside, half hour on road, walk and trot.
25. Same as 24, but jumping through chute without riders.
26. In hall same as 24.
27. In hall same as 25. Haunches in and out, through center of hall; 3' rail jump with riders.
29. In hall. Work-out, large circles, etc., as usual. Individual small circles in corners of hall, with lateral flexion to inside. Two tracks, haunches in (out), backing, turning on forehand, trot and gallop on straight lines, half turns in reverse, work by threes and extended gallop.
30. Same as 29.
31. In hall. Quiet work-out at trot. Individual halt from walk and resume walk promptly, to teach proper application of aids, and maintain suppleness, lightness, responsiveness and collection of horse. Exercise in light fingering of reins.

Jumping Class. January 3-14, ¾ hours per day; 15-31, one hour per day.

3. In hall. Suppling exercises for horses; slow gallop over two 3' wicker jumps on opposite sides of hall, trot between. Whips carried.
4. Same as 3.
5. In hall. Suppling exercises for horses and riders; jumping same, except 1½' wicker in front of one jump, and gallop between jumps.
6. In hall. Suppling exercises same as 5; jumping 3' wicker in center of hall at trot, no wings, and 3' 8" bar on track at gallop.
8. In hall. Suppling exercises; jumping 3' wicker and 3' to 3' 8" bars on track on same side of hall, slow trot and gallop.
9. Same as 8, omitting wicker.
10. In hall. Suppling exercises; jumping 3' wickers in center, 3' to 3' 8" bars in corner, slow trot and gallop twice over.
11. In hall. Suppling exercises; 8 jumps, 1½' to 2½', scattered about hall, taken by movement by flank from platoon, by fours, and by serpentine of column, two horses lengths between riders, slow trot, no wings.
12. In hall. Suppling exercises; four jumps in corners, 1½' to 2½', no wings.
13. In hall. Suppling exercises; two jumps 25' apart, 2' to 3', twice around at gallop.
15. In hall. Suppling exercises; horses through chute without riders, jumps 1½' to 3' high, 2' to 5' broad.
16. In hall. Trot and gallop at will and in pairs; gaiting; four jumps 2' to 4', on track, twice over at gallop.
17. In hall. Gaiting; suppling exercises; three jumps, 20' apart, 1½' to 3', twice over without stirrups or reins.
18. In hall. Suppling exercises; pig pen jump,—in and out, turn back and jump in, halt, jump out at side, across hall and halt at will, take track at walk, take top bar off jump, double back and take jump; jumps 2' to ??
19. Same as 18.
20. Same as 17.
22. In hall. Suppling exercises; two 3' jumps 14' apart.
23. In hall. Work-out 15 minutes. Outside, 45 minutes walk, trot and gallop on flat.
24. In hall, 30 minutes suppling and one 3' 8" jump. Outside, 30 minutes' walk and trot on road.
25. Same as 22.
26. Same as 11.
27. In hall. Suppling exercises, with and without stirrups and reins.
29. In hall. Suppling exercises; horses through chute without riders, jumps up to 4' high and 6' wide.
30. In hall. Four jumps on track at gallop, 3' to 4', twice over; suppling exercises.
31. In hall. Without stirrups, suppling exercises and three jumps, 1' to 3' high, 30' apart.

FEBRUARY.

Training Class. February 1-8, one hour per day; 9-29, 1½ hours per day.

1. In hall. Work-out; canter at will, both hands, small circles in corners; at will 15 minutes; lateral flexions at slow trot.
2. In hall. Work-out at trot; at will 15 minutes; at slow trot down center of hall, swing haunches right, straighten and swing left; haunches in at walk and slow trot.
3. In hall. Work-out; work at will; drill in all exercises to date.
5. In hall. Work-out at trot; canter at will; work at will, haunches to right and left, down center at slow trot; haunches in; canter in column, by flank in line, by threes down center; on right into line, horses stand at attention, dismount and mount on right side.

6. Same as 5. From head of column trot, slow trot, school trot, canter to rear of column.
7. In hall. Work-out canter at will; at will 15 minutes; haunches in and out.
9. In hall. Work-out canter at will; at will 15 minutes; drill at canter. Outside 40 minutes.
10. In hall. Work at will, both hands; platoon drill. Colts arranged in line in order of progress.
12. In hall. Work-out at will 20 minutes; drill at canter; haunches out.
13. In hall. Work-out; platoon drill at canter; 20 minutes at will; drill at slow trot; forehand in (out).
14. Same as 13. From head of column slow trot, canter left lead, slow trot, canter right lead.
15. Same as 14. Individual figures of eight at slow trot.
16. Outside, road work.
17. In hall. Work-out; platoon drill at canter; drill by threes; at will 15 minutes; individually slow trot, canter right, slow trot, canter left.
19. In hall. Work-out; canter by platoon, circles in end of hall; drill by threes at slow trot, abouts, on forehand to right and left, by flank, halts; forehand out, haunches right and left.
20. In hall. Work-out; at will 15 minutes; drill in column at slow trot, haunches right and left, two tracks, individual circles; individually down center, swinging forehand right and left; canter on circles.
21. Same as 20; taking alternate leads at canter from slow trot on straight lines; jumping low brush hurdle.
22. Outside for road work.
23. In hall. Work-out; drill by threes at slow trot; abouts, by flank, halts, on forehand right and left; at will 20 minutes; low brush hurdle.
26. In hall. Work-out; drill by platoons at slow trot; at will 20 minutes; special work for backward colts; low brush hurdle.
27. In hall. Work-out; drill through exercises at slow trot; at will 15 minutes; individually canter on circle, change circle at slow trot and take canter changing hand, both leads true. Two low brush hurdles.
28. In hall. Work-out; at will 20 minutes; haunches in; canter on circles; two low brush hurdles.
29. In hall. Work at will; collected walk, school trot; haunches out; canter on circles, both hands; two low brush hurdles at canter.

(Note.) Weather so bad that little outside work could be done. Colts got a little sour on inside work and constant application of aids, so that work had to be somewhat relaxed. A little cantering and jumping helped to relieve the situation.

School Class. February 1-8, one hour per day; 9-29, 1½ hours per day.

1. In hall. Quiet work, small abouts, and taking gallop. Talk by senior instructor. Horses through jumping chute.
2. In hall. Same as 1, but all jumps with rider up; practice in taking true lead at gallop, changing hands at trot and taking new lead at gallop.
3. Same as 2.
5. In hall. Long work-out at trot and gallop, with abouts on large and small arcs; at will, halting from walk and resuming walk, backing, and obtaining collection and suppleness; turns on forehand; horses through chute without riders, jumps 3' high.
6. In hall. Long work-out at trot and gallop; individually at slow trot on circles and figure eights around stakes, for accurate control and application of aids.
7. Same as 6.
9. In hall. Quiet work-out at trot; individually on two tracks; horses through chute with riders, two low jumps.

10. In hall. Work-out at trot and gallop; circles, spirals, figure eights; forehand in; on straight lines and on two tracks at slow trot.
12. In hall. Long trot at will; spirals and work by threes at trot and gallop; leaving column and taking straight line at trot and canter; horses through chute with two 3' jumps.
13. In hall. Work-out; work by threes, by flank, abouts, halting, and two tracks; collected canter and slow trot on straight line; small jumps in column with long distances, to get timid horses to follow and jump boldly.
14. Same as 13, but jumping individually.
15. In hall. Work-out; abouts and by threes; two track work; individuals on circles around stakes at canter, with attention to seat, cadence and collection.
16. In hall. Quiet work-out; work by threes; riding on points with various movements between points; low jumps.
17. In hall. Work-out; work by threes, halting, backing and by flanks. Effort at having individuals take canter on track to corner of hall, execute about and return to track by oblique on two tracks, to work up to change of lead at gallop; results not being good at gallop, repeated at slow trot.
19. Long work-out at trot, gallop and extended gallop; taking canter on inside track from slow trot; forehand in; through chute without riders; two jumps 3' 9".
20. In hall. Work-out; work by threes; individuals take different gaits between specified points, halt, back, and turn on forehand; talk on methods of teaching horse to take gallop.
21. In hall. Work-out; work by threes, halting, backing and by flanks; continuation of talk of 20th.
22. In hall. Work-out; by threes as on 21st; individually around stakes at canter; 3' jumps at gallop, riders up.
23. In hall. Quiet work-out; by threes at slow trot, halting and moving by flanks; individual exercises in taking walk, slow trot, canter between points, halting, backing and turning on forehand; jumping as on 22d.
26. Hall full of snow; walk, trot and gallop for horse exercise.
27. In hall. Work-out, with practice in taking canter; jumping at gallop, four 3' jumps.
28. In hall. Work-out; drill at slow trot in work by threes and taking canter from slow trot; horses through jumping chute; talk on methods of taking gallop.
29. In hall. Work-out at walk and trot; criticism and correction of work on two tracks; haunches in at slow trot; horses through jumping chute; continuation of talk of 28th.

Jumping Class. February 1-8, one hour per day; 9-29, 1-1/3 hours per day.

1. In hall. Suppling exercises; six jumps on track individually at slow trot from circles tangent to inner end; jumps 2' 3", no wings.
2. In hall. Suppling exercises; gallop in twos, threes and fours; riding and jumping without reins or stirrups, jumps 2' 3" high, 20' apart.
3. In hall. Suppling exercises; six jumps 2' 3" high, parallel to sides of hall, taken from serpentine.
5. In hall. Suppling exercises; pig pen jump, 3' 4", in at gallop and out at trot.
6. Same as 3.
7. In hall. Same as 1; outside, 15 minutes walk.
9. In hall. Suppling exercises; gallop in pairs; horses through chute without riders, jumps 3' 4" high, 3' 6" broad, 30' apart.
10. Same as 3.
12. Same as 9 except last jump 4' 3".
13. Same as 2.

14. In hall. Suppling exercises; four jumps 3' high, 16' apart, without reins.
15. In hall ½ hour; 3' in and out at slow trot. Outside 1 hour; walk and trot over varied ground, and ½ mile gallop.
16. Outside. 1 hour walk through woods, over small jumps on slippery ground. In hall ½ hour; jumps 3' high, 4' wide, quiet trot.
17. Same as 3, but all work without stirrups.
19. In hall. Work-out; gallop in pairs; in and out 3' to 3' 8", halt 10 yards beyond and return.
20. In hall. Suppling; three 3' jumps, twice around at gallop, no wings.
21. Same as 19.
23. Outside. Up and down cañons at walk, gallop between.
24. In hall. Same as 20, but one jump 4' high with wings.
26. In hall. Quiet work suppling.
27. Outside. Trot and gallop in woods, small jumps.
28. Same as 2, but all jumps 3'.
29. In hall. Same as 9.

Second Training Class. February 12-29, ¾ hours per day.

Additional class, to give officers opportunity to train two horses during year; 21 horses were thoroughbred colts coming 4 years old, 6 backward colts from regular class. Most colts from Kentucky or Virginia, and had been handled more or less, but had been loose in pasture for some months, and had to be treated like green horses.

12. Horses quietly bridled in stalls by student officers and led to riding hall; little difficulty experienced. Horses handled, petted, rubbed with riding whip. When quiet, effort made to lead them, walking beside shoulder and urging horse with tongue and with gentle taps of whip on side, where leg would be used. Work done on both hands.
13. Same as 12.
14. Same as 12; also putting on cavesson and longing in small pen.
15. Same as 14; officers change horses daily.
16. Same as 14, but pens slightly larger.
19. Horses temporarily assigned to officers; longed both inside and outside of pens; horses led, officers beside shoulder, effort made to keep horses light against bit, head well carried.
20. Same as 19; pens larger, and surcingles put on some horses.
21. Same as 20; blankets put on.
23. Same as 21.
26. Same as 21.
27. Same as 21.
28. Longing as before; saddles on after 15 minutes. Near end of lesson most of horses were mounted and some ridden a short distance.
29. Same as 28.

MARCH

Training Class. 1½ hours per day.

1. In hall. Work-out; work at will; collected walk and school trot; one platoon at a time on track, canter at will, with small circles at ends of hall; low brush and bar jumps mounted.
2. In hall. Work-out; canter as on 1st; drill by threes in center; haunches right and left, two tracks oblique, halts, turns on forehand, abouts; individual figures of eight at school trot; low brush jump.
4. In hall. 2nd platoon in morning, work-out at trot and canter, drill in two-track work. In afternoon, 1st platoon exhibition for Kansas Agricultural College students.
5. In hall. Drill by threes in center; individually, school canter; small brush jump.
6. In hall. Work at will; drill by threes at canter; individually, haunches in, straighten, and haunches out at school trot; canter over low bar.

7. In hall. Drill at trot and slow trot; individually, collected walk, school trot, obliques on two tracks, haunches right and left; low bar jump.
8. In hall. Long trot on both hands; drill in one-track movements; individually, school trot, and small circles at school canter.
9. In hall. Work-out; short extended trot; canter right and individually on circles; canter left, first rider front to rear; slow trot, rear rider on small circle as called; individually, canter alternately left and right from school trot; low bar jump.
11. In hall. Work by threes, serpentine, and canter on track; individually, canter alternately left and right from school trot; jumping bales of hay.
12. In hall. Drill by threes at trot; canter by platoon and first rider front to rear; gallop from slow trot; low brush jump.
13. In hall. Drill as on 12th; individually, half turn on haunches at school trot; low brush jump at canter.
14. In hall. Work out at canter, both hands; half turn on haunches; low brush jump.
15. In hall. Canter by threes down center; individually figure eight on haunches at slow trot.
16. In hall. Drill at canter and school trot; figure eight on haunches; in pairs, tandem and abreast, over jump made of bales of hay.
18. In hall. Work-out. Outside for road work; at walk over low brush in pairs, tandem and abreast.
19. Outside. Road work at walk.
20. In hall. Work at will; forehand in at school trot; jumping in pairs, tandem and abreast.
21. In hall. Gaiting at four-mile walk; trot by threes; canter on track at extended distances; gallop on loose rein, low frame jump.
22. In hall. Work-out at trot and canter. Outside, road work.
23. In hall. Work-out at trot by threes; drill by platoons; gallop by threes; figure eight on haunches; standing horses at attention.
25. Outside one hour. Road work at walk. In hall ½ hour; canter, first rider front to rear, canter in pairs tandem twice around; canter alternately left and right from school trot.
26. Outside one hour. Road work at walk. Inside ½ hour; canter alternately left and right from school trot; low bar jumps.
27. In hall. Gaiting at eight-mile trot; haunches right and left, obliques on two tracks at school trot.
28. In hall. Gaiting at eight-mile trot; at school trot haunches in, straighten, forehand out. Outside ¾ hours, jumping logs and wading stream up to stifles.
29. In hall. Gaiting at eight-mile trot. Outside ¾ hours, road work, through woods, over logs and low hurdles.
30. In hall. Gaiting at twelve-mile gallop; individually down center at school trot, taking canter three times, alternate leads. Outside ¾ hours; canter on flats 1¼ miles.

School Class. 1½ hours per day.

1. Same as Feb. 29.
2. In hall. Long work-out at walk, trot and gallop; two-track work, and riding on straight line at collected trot.
4. In hall 1 hour in morning; chiefly horse exercise; in afternoon 20 minutes' exhibition for Kansas Agricultural College students.
5. In hall. Long work-out; quiet work by threes, especially in halting, backing and moving forward promptly; talk on changing lead at gallop; horses through jumping chute.
6. In hall. Long work-out; work by threes at all gaits; changing lead at gallop by changing hands diagonally across hall; jumping chute.
7. In hall. Long work-out; by threes at walk, slow trot, trot, gallop; on

- two tracks in column at slow trot; change of lead as on 6th; jumping chute.
8. In hall. Work-out; work by threes; two-track work in column at slow trot; talk on gallop and change of lead.
 9. In hall. Work-out; exercises by threes, on two tracks, and changing lead at gallop.
 11. In hall. Bit and bridoon bridle put on; talk on adjustment of bit and curb chain, action of bit, and methods of holding reins; horses exercised half-hour at walk and trot.
 12. In hall. Work-out; walk, trot and gallop, both hands; exercises by threes, abouts, by flanks, two tracks, backing, turning on forehand, halting from trot; first rider from front to rear on large circle at gallop; on straight line at trot; front to rear at trot between column and wall. All work with double bridles, curb reins slack. Horses over two jumps in chute, 3' and 3' 6". Demonstration of use of whip dismounted, causing colt to yield haunches.
 13. In hall. Same as 12, but instead of jumping in chute horses put over two 3' jumps, riders up, curb chains unhooked.
 14. Same as 13, but no jumping; change of lead at gallop; direct flexion of jaw by use of curb bit, dismounted.
 15. Same as 13; flexion of jaw, dismounted, by curb and snaffle.
 16. In hall. Work-out at walk, trot and gallop, holding double reins in one hand, both right and left; in threes by flank, abouts, two tracks, halting from trot, backing, turning on forehand; serpentines, circles, trot and gallop on straight lines; two 3' jumps, curb chains unhooked.
 18. In hall $\frac{3}{4}$ hour. Work-out at walk, trot and gallop; two 3' jumps; direct flexion dismounted. Outside $\frac{3}{4}$ hour on road at walk and trot.
 19. Outside 1 hour. Over hills 6 miles, walk, trot and gallop. In hall 20 minutes; horses through jumping chute, two 3' jumps without riders.
 20. In hall. Work-out; work by threes, by flanks, backing, on two tracks, haunches in, forehand in, halting, change of lead at gallop; demonstration of method of obtaining good carriage, collection, and direct flexion, horse moving to front and rider dismounted.
 21. In hall. Work by threes around stakes at walk, trot and canter, also change of lead at gallop in passing between stakes. Explanation of carriage and use of whip; direct flexion dismounted, horse between rider and wall.
 23. In hall. Work-out; work by threes, by flanks, backing, turning on forehand, taking and changing leads at canter; through chute with riders, two 3' jumps.
 25. In hall 20 minutes, then on road at walk and trot 55 minutes; returned to hall, jumped in column and individually, 3' hurdles. Direct flexions and placing of head and neck by means of whip, riders dismounted, horse between rider and wall.
 26. In hall. Work-out on both hands at trot and gallop; by threes in abouts, by flank, two tracks, halt from walk and slow trot. Explanation and demonstration of "shoulder in." Practice in carriage and use of whip. Use of reins at gallop, and holding when horse pulls.
 27. In hall. Work-out; movements on circles and by flank, halt from trot, facing to flank and backward; gallop from slow trot on straight line; two 3' jumps in column several times.
 28. In hall. Work-out on track, both hands, 10 minutes; by threes, including change of lead with change of direction; halt, turn on forehand, and haunches right or left at designated points; whip exercises.
 29. Outside one hour. Over jumps in woods. In hall $\frac{1}{2}$ hour; half turns on haunches; half turns on forehand and figures of eight; taking lead on straight line down hall, changing as often as possible with smooth work by coming to slow trot.
 30. Outside $\frac{1}{2}$ hour, at will on road in pairs. In hall 1 hour; exercises by threes; changing lead at gallop; whip exercises; shoulder in.

Jumping Class. 1½ hours per day.

1. In hall 1 hour, without stirrups. Outside ½ hour, walk and slow trot on road.
2. Walk and slow trot on road.
4. In hall in morning, 45 minutes work out. In hall afternoon, exhibition for Kansas Agricultural College students. Suppling exercises without stirrups or reins; jumping at gallop twice around, two 3' 8" bar jumps on one side of hall, three 3' jumps on other side, 20' apart; without reins or stirrups over the 3' jumps; without stirrups once around at gallop over all jumps.
5. In hall 1 hour. Work-out; twice over double jump and back in pairs at trot; same one by one from column at trot; same at gallop. Outside ½ hour, walk and trot on road.
6. Short gallop through woods; through hill pasture over seven jumps 3' 6", walking between.
7. In hall. Work-out; suppling exercises for riders at gallop; jumping from column at trot; same without reins, arms folded; same without reins or stirrups, arms folded; jumps 3' high, 20' apart.
8. In hall. Suppling; jumping through chute without riders, up to 4' 3" high, 6' broad.
9. In hall. Suppling exercises, and riding and jumping with and without stirrups and reins; four jumps 3' high, 20' apart, over three times, arms folded.
11. In hall. Suppling; five jumps on track, 3' to 3' 9", no wings, around twice at gallop.
12. In hall. Gaiting, six and eight-mile trot, one mile at fifteen-mile gallop; after five minutes repeat on other hand, then half-mile same rate. Jumps same as 11th, on other hand.
13. In hall. Suppling exercises; gaiting; other work same as 9, except jumps 16' apart, changing reins from one hand to other or dropping them between jumps; during other work reins held in outer hand, whip in inner.
14. In hall. Half-hour suppling. Outside ¾ hour, walk and trot and a few small jumps.
15. Same as 13, except five jumps.
16. In hall. Gaiting, one mile slow trot and trot, one mile at fifteen-mile gallop, then after five minutes one mile at twelve-mile gallop. Outside, half-hour road work.
18. In hall. Gaiting, half-mile slow trot, half-mile trot, one mile sixteen-mile gallop and after five minutes repeat; five jumps on one side 3' to 3' 8", on other side triple bar 3' wide, 3' 9" high, twice around; reins in one hand. Outside 15 minutes.
19. In hall. Gaiting, half-mile slow trot, half-mile trot, practice at twelve and sixteen-mile gallop. Outside one hour; leaving hall individually one minute apart, walk one mile, slow gallop one mile over Republican jumps, walk home.
20. In hall. Suppling exercises; riding without stirrups or reins; over six jumps 3' high, 20' apart, reins in one hand, changing at each jump.
21. Same as 18.
22. In hall. Mile at fifteen-mile gallop, repeat in two minutes. Outside, walk, trot, gallop and hill climbing.
23. Same as 20.
25. In hall. Work-out at walk, trot and gallop; on one side of hall, 4' stone wall, triple bar 2' 6", 3' 1" and 3' 9", and combined jump 5' wide; on other side three 3' jumps 12' apart; over all three times.
26. Same as 19.
27. In hall. Work-out in pairs at trot and gallop; suppling; six jumps 2' 8" high, 12' to 22' apart, once over, changing reins from one hand to other between.

28. Outside. Weighed horses; through ravines at walk.
29. Outside in pairs, walk and trot, $\frac{3}{4}$ hour. In hall; enter one at a time, once at gallop over 3' 6" stone wall, 3' 9" triple bar, three 3' jumps, all on track, and two 3' 8" bars in center of hall.
30. Outside. Leaving separately $\frac{3}{4}$ minutes apart, walk $\frac{3}{4}$ mile, then walk and gallop at will $1\frac{1}{4}$ miles across country over five post and rail jumps 3' 6" to 3' 9"; walk home.
Second Training Class; $\frac{3}{4}$ hours per day.
 1. In hall. Same as Feb. 28; all horses mounted and ridden short time at walk.
 4. In hall. Half-hour in morning, horses longed and saddled, most of them mounted and quietly ridden. Afternoon, 20 minutes' exhibition for Kansas Agricultural College students.
 5. In hall. Horses longed, saddled, ridden at walk and slow trot.
 6. Same as 5, riding in column.
 7. Same as 6.
 8. In hall. Longing without pens; riding in column, horses leading in turn.
 11. Same as 8.
 12. Longing and riding as usual. Application of whip, rider dismounted, to make horse yield haunches.
 13. Same as 12.
 14. Same as 12; horses worked a little in column, and turns made by flanks by opening inner rein and applying inner leg.
 15. Horses longed, mounted, ridden at will in column at extended distances; by flank at walk and slow trot; yielding haunches to whip, rider dismounted.
 18. Same as 15.
 19. Same as 15.
 20. Same as 15, but less longing, more riding and more work by flank.
 21. Same as 20.
 22. Same as 20.
 25. Same as 20.
 26. Longing and riding at will, walk and trot; work in column at walk and trot, with practice in moving by flank; yielding to leg by "on forehand half turn in reverse" for a few steps.
 27. Same as 26.
 28. Same as 26, with more work at trot, by flank, half turns in reverse.
 29. Same as 28.

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.)

March, 1912.

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

Continuation of article in December number (see Field Artillery Journal, March, 1912). Dr. Mann's experiments are described in much detail, and illustrated by diagrams.

The Gold Coast Artillery Corps, 1851-63.—Major J. J. Crooks, African Commissariat, Retired.

Some curious bits of history about one of the obscure colonial corps that England has often had occasion to organize for special service.

Combined Signalling.—Captain A. F. U. Green, R. A.

Points out that possession of a number of qualified signallers does not necessarily imply ability to maintain a complicated system of communication; and suggests lines on which to work to develop an efficient signal organization for the requirements of a seacoast fortress.

A Contribution to the Field Gun of the Future.—Gen. Rohne.

Translation from *Militär Wochenblatt*, July 11, 1911.

Five Years' Experience of Artillery Inspections.—Gen. Percin.

Translations of the extracts from General Percin's forthcoming book that have recently appeared in the *Journal des Sciences Militaires*.

The Employment of Field Artillery in the French Army.—Gen. Richter.

Translation from *Artilleristische Monatshefte*, August, 1911.

Horse Artillery and its Work with Cavalry.

Translation from *Voyennui Sbornik*. Discusses the history and tactics of horse artillery, and gives credit to Peter the Great as the first to give a regular organization to this arm.

April, 1912.

The New System of Food Supply.—Major P. Hazelton, A. S. C.

The writer mentions briefly the great difficulty of keeping up supply at any distance by means of animal transport, and explains in a general way how these difficulties are to be lightened by the use of mechanical traction in the supply columns, drawing supplies direct from railway cars and issuing to divisional wagon trains. He then discusses a little more fully some of the questions involved in the new method of handling railway trains, and in transfers from supply columns to divisional trains.

The Tactical Handling of Field Artillery.—Major S. F. Metcalfe, R. F. A.

A statement of the advantages and disadvantages of covered, semi-covered and open artillery positions.

The Compilation of Range Tables.—Lieut. A. F. B. Harvey, R. A., and J. W. Hicks, F. R. A. S.

A description of the process of constructing a range table, including the firing, analysis of the practice, computations, and compilation of the table; with notes on droop and jump of guns, coefficient of reduction, drift and wind.

Training of the Garrison Artillery.—Captain C. N. Buzzard, R. G. A.

Proposes modifications in target practice, and in method of determining "company figure of merit."

Retrospect on the German Maneuvers in 1911.

Translation of article in *Artilleristische Monatshefte* for December, 1911, summary of which appeared in the *Field Artillery Journal*, March, 1912.

Memorial de Artilleria.—Extracts from the January number.

May, 1912.

Organization and Training of Territorial Field Artillery.—Lieut. Col. G. R. F. Talbot, R. F. A. (T).

This article should be of interest to Americans, by reason of the similarity of the problems confronting the English Territorials and our Militia. The principal suggestions made deal with the horse question. The writer urges that Territorial drivers will always be unskilled and horses always untrained at mobilization; hence the mobility to be expected from teams made up as in the Regular service must be small. He therefore proposes that the batteries be prepared, not for rapid maneuvering, but for straight-away walk on roads or across moderate country; to this end he favors four heavy draft horses instead of six lighter ones. Experiments of this kind have given good results in our own country. He also suggests that in some cases saddle horses might be replaced by bicycles. His proposals regarding ammunition columns are of less direct use to us; but the idea of a special Territorial handbook, explaining and emphasizing the more simple methods of preparation of fire (which are passed over lightly in the drill books), is good.

Hits at Fixed Armament Practice.—Captain M. A. Beattie and Lieut. E. M. C. Clarke.

Criticizes certain regulation methods of scoring coast artillery target practice, and proposes changes.

Wireless Telegraphy.—Prof. H. T. Davidge.

A lecture delivered at the Royal Artillery Institution, January 11, 1912. It is interesting to the lay reader, being strictly non-technical and elementary.

A Further Retrospect on the German Maneuvers of 1911.

Abridged translation from *Artilleristische Monatshefte*, January, 1912, (see *Field Artillery Journal*, March, 1912).

Tactical Coöperation between Artillery and the Other Arms.

Translation from *Rivista di Artiglieria e Genio*, September, 1911, of an interesting and useful paper.

A "World's Triumph" in Gun Construction.

Translation from *Jahrbücher für die deutsche Armee und Marine* of a criticism on an unidentified American press dispatch concerning a new 16-inch gun. The original note having been of no authority, it is odd that any paper should have spared space to comment upon it, much less to translate the comment.

Coast Defense.

Précis of an article in *Streffleur's Militärische Zeitschrift* concerning coast artillery matériel.

REVUE D'ARTILLERIE. (Librairie Berger-Levrault, Rue des Beaux-Arts, 5, Paris.)

February, 1912.

Acrostation and Aviation.—M. Clémentel.

Continuation of official report, begun in the January number (see *Field Artillery Journal* for March).

Observation on Artillery Team Horses in Africa.—Lieut. I. Hervé.

The writer considers the French half-bred preferable to the native Arab for artillery work in Africa; he finds well-selected mules more suitable than the latter, if French horses are not available.

Sighting Device for Aeroplanes.—M. Brocq.

Description of an instrument constructed on the principles developed in the writer's article published in the *Revue* for December, 1911 (see *Field Artillery Journal* for March).

Siege Artillery in Defense of Fortresses.—Colonel E. Lombard.

A brief paper laying down the principles of artillery defense under present conditions.

March, 1912.

Artillery Aviation.—Captain Charet.

A lecture delivered at the Paris Military Club. The lecturer reviews the experiments made in observing fire from aeroplanes, contends that their results justify a special flying service as an organic part of the artillery, and proposes an organization for this service.

Aeroplane Ballistics.—P. Charbonnier.

A mathematical discussion of the problem,—“one aeroplane is pursuing another; their armament is identical; which has the advantage, ballistically?” The writer concludes that the ballistic advantage is always with the *pursued* aeroplane (or ship).

Large Caliber Field and Siege Guns.—Captain Peloux.

The first of a series of papers on Schneider matériel. It treats of field howitzers, giving a brief general discussion of the subject, and describing in some detail, with many drawings and photographs, the Schneider 105, 120 and 150 mm. howitzers.

April, 1912.

Large Caliber Field and Siege Guns.—Captain Peloux.

A second paper in the series begun in March. The subjects treated are heavy field guns, and siege howitzers and mortars. The Schneider pieces described are the 105 mm. rifle, 15 and 21 cm. howitzers, 24 and 28 cm. mortars. The last mentioned is the same piece briefly described in the *Field Artillery Journal* for March.

Aeroplane Ballistics.—P. Charbonnier.

Discusses mathematically the “problem of ballistic defilade.” That is to say,—two aeroplanes, armed with light machine guns, are maneuvering against each other; one keeps an even speed, course and altitude, to make its gun platform as stable as possible; what is the safest method of maneuver for the other? Considering that an aeroplane is most vulnerable in its horizontal surface, and least vulnerable “end on,” the writer calculates a course for the second aeroplane which will always keep it tangent to the trajectory of the projectiles of the first, and suggests the principle for an instrument by which this course may be kept.

Results of Service Practice.—Major J. Dedieu-Anglade.

Extracts from reports of some recent firing, showing rapidity attained

in fire from positions with high defilade, the battery commander being 200 or 300 meters from his guns. The writer believes methods of preparing fire are too numerous and too complicated; he objects to the use of a common aiming point, preferring rough orientation of the directing gun and formation of the sheaf upon it. He explains various schemes for making such preparation quick and accurate.

ARTILLERISTISCHE, MONATSFESTE. (A. Bath, Mohrenstrasse 19, Berlin).

February, 1912.

Questions of Artillery Organization.—Gen. Rohne.

A comparison of peace strengths, in men and horses, of French and German batteries, with a discussion of the proper number of guns in a battery and batteries in a corps. The writer points out that, while the German battery in peace has more men and horses, still, since it has six guns, it has to borrow more to turn out a full battery for field exercises, and hence gets a chance to do this work less often. He believes that, in any case, 144 field guns, besides heavy artillery, are too many for a corps, and recommends that the number be reduced and the strength in personnel and animals increased. In such a reduction he favors making the number of guns in a battery four, instead of cutting down the number of batteries.

Notes on the Kinetic Theory of Gases.—Colonel P. Haupt.

Continuation of a discussion, participated in by Lieut. Col. Engelhardt, Col. v. Kobbe, and the writer, on this theory as applied to the atmospheric resistance encountered by projectiles.

The Artillery of the Defense in Fortress Warfare.—Capt. Max Kralupper, 3d (Austrian) Fortress Artillery.

The writer favors, for a large fortress such as Port Arthur, an increase in mobile batteries at the expense of fixed ones, a decrease in the number of guns and a corresponding increase in ammunition supply, and greater attention to facilities for reconnaissance and observation of fire.

The New German Firing Regulations.—"M."

Brief comment on Lieut. Col. Hidikata's article on this subject in the October number (see Field Artillery Journal for December).

Horseshoeing and Care of the Hoof.

Practical suggestions on elementary points, such as all mounted officers ought to understand.

The "Liberte" Catastrophe, and the Powder Question in the French Navy.

A very complete account of the explosion, and of the plans for preventing such accidents in future. The writer falls into a common error in suggesting that the loss of the "Maine" was due to nitrocellulose powder similar to that on the "Liberté."

A Logarithmic Graphic Table for Calculating Recuperator Springs.—C Waninger.

Explanation and illustration of a graphic table for calculating the dimensions of recuperator springs. The complicated equations are fire reduced to logarithmic form, and their curves then plotted on a system of logarithmic rectangular coordinates. The equations being now all of the first degree, the curves reduce to straight lines, and the construction and use of the graphic table are very simple.

March, 1912.

Artillery on the March.—Gen. Rohne.

A good brief paper on marching, written by reason of the fact that the German regulations contain very little on the subject.

Ammunition Column Training.—Captain Bath.

An account of the exercises in handling ammunition columns, conducted by the writer for his regiment in 1911. Parts of the work described, and especially the field exercises of the last day, might easily be adapted to our own use, in spite of differences in organization. As the writer suggests, such work need not interfere with any other training, but, in large posts, might be used to give additional interest to short practice marches.

Artillery in the Infantry Attack.

A review of Captain Linares' book, "La Tyrannie de l'Arme a Feu," pointing out how the writer, an infantry officer, working from his own standpoint, has reached the same conclusions as General Percin and other artillerists as to the coöperation of the two arms in the attack.

Firing Regulations of the Russian Field Artillery.

A translation of the new regulations for the 3-inch rapid fire gun.

A French Battalion Firing P. blem.

Complete description, with map, taken from the *Revue d'Artillerie*, of the firing problem noted in the March Field Artillery Journal, where the batteries were far behind their mask and the officer conducting the fire had to be 750 m. from his guns.

Naval Attacks on Coast Fortifications.—Lieut Goliasch.

Discussion of certain points raised in the article under this title by Captain Berger, published in the September number (see Field Artillery Journal for December).

Difference in Elevation, and Angle of Site.—Col. v. Kobbe.

The German mil being $1/16$ of a degree, and the least reading on the angle of site scale being $2\frac{1}{2}$ mils, transformation of linear into angular measure is less easy and accurate than with us. The writer here proposes a handy method for effecting this transformation either graphically or analytically.

Horseshoeing and Care of the Hoof.

Continuation of paper begun in February.

April, 1912.

Dropping Bombs from Flying Machines.—S. v. Kobbe.

A paper inspired by the discussion of this subject in the *Revue d'Artillerie* for December (see Field Artillery Journal for March). It reviews Charbonnier's calculations on the trajectories of this kind of missiles, and the degree of accuracy to be expected, and brings forward for comparison others on another principle. Instead of the complicated sighting device described in the *Revue*, the use of a scale like a battery commander's ruler is proposed; the distance in front of the target at which the bomb must be dropped, for a given height and speed, is taken from a graphic table, and a point at the proper distance on the ground selected by means of the rule; the bomb is dropped when directly above this point.

Simplification of Firing Methods.—Lieut. Col. Hidikata.

Suggestions for improved mechanism of fire, by a well-known Japanese officer. They refer in particular to the German regulations, and contain little that is applicable to ours.

Attack of Mountain Fortifications.—Capt. L. v. Majneri-Kempen.

Referring to his own paper on mountain fortifications in the June number, 1911 (see Field Artillery Journal for September), the writer develops at some length his views as to attack of such works.

Accidents with Guns and Ammunition, 1909-11.

A full tabulation, arranged by countries, of all recorded accidents of this nature, both on land and sea, with brief notes on their causes. The total number listed is 103; the casualties were 341 killed and 510 wounded. Of these accidents, 13 occurred in the United States, killing 20 and wounding 16.

Horseshoeing and Care of the Hoof.

Continuation of paper begun in February.

May, 1912.

A Field Artilleryman on the New Army Program.—Gen. Rohne.

The writer reviews the new plan, under which the German Army is increased from 23 to 25 corps. He concludes that in spite of the increased number of batteries the German artillery is still inferior in power to the French, by reason of its six-gun organization, and argues for making the light artillery of each corps 120 guns, in thirty four-gun batteries, instead of 144 in twenty-four six-gun batteries, insisting that the numerous small batteries can, in a given time, deliver more well-aimed projectiles at the target than the fewer large ones, especially since the small batteries can carry more ammunition per gun than the large ones. He even hints at a three-gun battery. He also deplors the small strength of the German batteries in men and horses, and points out that by his plan the peace strength per gun could be larger.

The Dutch Field Artillery.

The Dutch division has hitherto had only six batteries, of six guns each, organized as a two-battalion regiment. In a recent reorganization, financial considerations preventing an increase in the number of guns, an effort has been made to get increased efficiency by a new plan. The regiment is now organized in three two-battery battalions; the six-gun battery is merely an administrative unit. In action the captain and the senior lieutenant each commands a half-battery, and each is fully provided with reconnaissance and signal personnel and matériel. New firing regulations have been adopted, of which this paper gives an extended synopsis.

Mechanical Determination of Deflections.

The writer describes at length (and certainly does not minimize) the delays and inaccuracies that may occur in calculating deflections, and describes the instruments used in the Austrian artillery for determining them automatically.

The Russian Field Artillery.

The reports of all Russian artillery inspectors are annually compiled by a board of officers, and the deficiencies noted are referred to the Artillery Committee with recommendations for improvements. This paper is a review of the report of the Committee for April, 1911, dealing with the reports for 1910.

The Armament of Warships.—Captain Berger.

An investigation into the proper calibers and types of ship guns, their mountings and methods of fire.

Kinetic Theory of Gases.—Col. v. Kobbe and Col. Haupt.

Continuation of the discussion in the February number.

MISCELLANEOUS ARTICLES.

MATÉRIEL.

French Horse Artillery Gun.

As is well known, the French Horse Artillery has never yet had a modern gun. Three types are now under test; one of them is of the

new Deport type described in the Field Artillery Journal for March. It is hoped that the weight of the piece limbered may be reduced to 3,300 pounds.

Artilleristische Monatshefte, February, 1912.

Russian Light Field Howitzers.

The Russian army corps has, as a rule, two batteries of 12-cm. field howitzers (spoken of in Russian papers as mortars). Four models are in use,—two Krupp, one Obuchof and one Schneider. Weights, dimensions, etc., of the last named model are given.

Artilleristische Monatshefte, February, 1912.

Russian Guns and Ammunition in Manchuria.

The number of modern guns with the Russian army in the late war is given as 1,400. Of these 129 were lost in action, and 83 became unserviceable. After 2,000 rounds the guns became so worn as to lose their accuracy. Numerous Russian sources are quoted to show that great and unnecessary waste of ammunition occurred. It seems to have been common to empty caissons at the gun positions, and send them back to refill, so that much ammunition was lost in changes of position. Fire appears to have been reckless and uncontrolled, and not at all proportioned to the importance of the targets.

Streffleur's Militärische Zeitschrift, December, 1911.

Automobile Gun.

Suggestions for a motor-driven armored gun. The carriage is to be of the "caterpillar" type, borne on an endless belt driven by large cogwheels; the three or four centimeter high power gun is to be in an armored turret with a maximum thickness of 8 millimeters. The most novel feature is the provision of adjustable outriggers in front and rear, controlled by power from the motor, which give the necessary support to permit crossing a wide ditch, getting over a bank, etc. Places are provided for three men, two in the turret and one at the motor; the motor man serves ammunition when the gun is in position. No estimate of weight is given.

Streffleur's Militärische Zeitschrift, February, 1912.

Balloon and Aeroplane Guns and Ammunition.

A review of the various types of matériel for fire against air craft, constructed by the leading European gun makers.

Mitteilungen über Gegenstände des Artillerie- und Geniewesens, No. 4, 1912.

The Question of the Light Field Howitzer.

A discussion of the use and value of the light field howitzer, urging strongly that experiments be undertaken to determine the advisability of substituting such pieces for a part of the 75-mm. rifles, with which the French field artillery is now exclusively armed.

Journal des Sciences Militaires, April 15, 1912.

Illuminating Projectile.

Brief description of a Krupp projectile which, bursting in the air, leaves a light hanging from a sort of parachute. The power and duration of the light are not given, but are claimed to be considerable.

Deutsches Offizierblatt, April 11, 1912.

ORGANIZATION.

Assignment of Artillery to Large Commands.

Tabulation of the artillery components of divisions and corps in the leading European armies and in Japan.

Schweizerische Zeitschrift für Artillerie und Genie, December, 1911.

Light Howitzers in Germany.

Each infantry division, instead of one division in each corps, is here after to have one battalion of its artillery brigade armed with howitzer.

Bulletin de la Presse et de la Bibliographie Militaires, March 31, 1912.

Horse Batteries for German Cavalry Divisions.

Each cavalry division (three brigades) is hereafter to have its horse artillery organized in three four-gun batteries, instead of two six-gun batteries.

Artilleristische Monatshefte, May, 1912.

TRAINING.

Russian Firing Regulations.

Translation of the firing regulations for Russian batteries armed with the 3" rapid fire gun.

Mitteilungen über Gegenstände des Artillerie- und Geniewesens. No. 2, 1912.

Firing over Friendly Troops.

A number of experiments in Russia indicate that with their guns the danger zone for friendly infantry is at least 600 meters in front of the guns and 400 meters in front of the target.

Artilleristische Monatshefte, February, 1912.

Night Firing.

Description of night firing experiments made in Switzerland in September, 1911. The battery was assigned its target (a bridge) and took position during the day; the line of fire of each gun was marked by stakes and screened lanterns. An observer was posted 150 m. on each flank, and laid out his own line to the target in the same way. In adjusting fire these observers reported only "in" or "out"; two "ins" of course showed a "short," two "outs" an "over." Adjustment was by piece, with percussion fire, followed by a verifying salvo time fire, then volleys. Thirty rounds were fired, the target representing infantry in column on the bridge; 175 figures out of 220 were hit, by 408 bullets.

Schweizerische Zeitschrift für Artillerie und Genie, December, 1911.

TACTICS.

The Guns of a Division in Action.

An outline of the operations of divisional artillery in all stages of a battle, along conventional lines, with special attention to the batteries temporarily held in reserve. At the close, the principles are applied to conditions in India. The British battery has six guns, and the writer seems to feel the need for more separate units, rather than for more guns; he suggests detaching a platoon from each battery of a battalion for separate use, and working the battalion with four-gun batteries.

Journal of the United Service Institution of India, January, 1912.

Fire for Neutralisation; Combination of Arms.

In a well-written paper entitled "La Fin d'un Désaccord," Lieut. Col Thionville attempts to harmonize the existing disagreements on these subjects. According to his view, fire for neutralization is merely a name, not a separate thing; all fire is primarily for destruction, and if for any reason, it fails to destroy, it may secure the minor result of neutralization. In the matter of command, he defends the idea expressed in the new regulations, that artillery should not be split up and attached

to temporary battle groups if it can be avoided. He endeavors, however, to clear up what he believes to be misunderstandings of the meaning of the regulations, and proposes amendments which will make this meaning clearer.

Journal des Sciences Militaires, May 15, 1912.

BALLISTICS.

Gyroscopic Action of Rotating Projectiles.

Mathematical discussion of the motion of an elongated projectile, with applications to matters of drift, twist of rifling, etc.

Mitteilungen über Gegenstände des Artillerie- und Geniewesens, No. 4, 1912.

GENERAL.

The French Field Artillery.

A most excellent paper, by an English officer who has had large opportunities for observation. He goes over everything,—matériel, organization, drill, firing methods, application of fire, tactics and training,—and makes no concealment of his conviction that in many respects the French system is superior to the English. The part of the paper most interesting to us is that on training,—particularly the organization of the annual firing practice, the system of firing without range parties, and the use of infantry officers to outline the course of the infantry action for the officer conducting the fire.

Army Review, April, 1912.

BOOKS.

EArtillerie dans la Bataille.—Col. J. Paloque. Paris, C. Doin & Fils, 1912.

This is a new volume of the *Encyclopédie Scientifique*, and one not foreseen in the original tentative plan of that series. Apparently the author's former book in this series, *Artillerie de Campagne*, has excited a demand for more of his work. The former book dealt chiefly with artillery matériel and technical matters; its one chapter on artillery in battle called for expansion.

Colonel Paloque is singularly free from any tendency to solve his problems by a formula. This appears strikingly when he touches upon the much-discussed question of command,—of assigning guns to an infantry attack, or assigning them to support it. Both by argument and illustration he urges that both systems are right when in their proper place, and both wrong otherwise. He refuses to accept a more rigid rule for detachments from the principal artillery command than that for any detachment of any arm,—avoid them if you can, make them if you must.

The principal novelty that he proposes is in his tactical subdivision of artillery, not into *infantry batteries* and *counter batteries*, but rather into *artillerie de première main* and *artillerie de deuxième main*. He objects, very reasonably, that the former nomenclature tends too much to rigidity. His point is that the classification should be subjective, not objective; that it should depend upon what you want to accomplish with your guns, not upon what kind of target the enemy may offer to them. Batteries *de première main* should not be called *infantry batteries*, because, in helping the infantry they may have to fire upon artillery, cavalry, anything; nor should batteries *de deuxième main* be called *counter batteries*, for their business is to preserve liberty of action to the other class, and in so doing their target is not necessarily artillery. Question of nomenclature, perhaps, but not mere immaterial verbal criticism; more than once the name *reserve artillery* made trouble when it was not properly understood, and these names also are subject to misunderstanding.

The first part of the book. Characteristics of Artillery, is treated in a very conservative manner. Far from trying to claim everything for his own arm, the writer emphasizes its disabilities as strongly as its powers; he fears the consequences of over-estimation by others more than he does the opposite.

Part II treats of march formations,—assignment of artillery to marching columns, and to positions within the columns. An interesting discussion of the marching powers of artillery is found here.

Part III traces the course of action of the artillery from the time it is first called for until it opens fire for effect. The matter of orders is treated somewhat in detail. Orders are analyzed to determine the essentials of good ones; and the point is made that artillery is not a technical thing that the general need not understand,—that it is simply one of the tactical tools that the general has to use, and that it is the business of everyone, artilleryman or not, who gives an order to artillery to understand the full effect of that order. Some good hints on reconnaissance are also given.

Part IV, Combination of the Arms, enters upon controversial ground; but, as noted above, the writer refuses to be led into the error of taking sides. Besides dealing with this particular aspect of the subject, he gives a very good discussion of the principles governing the use of artillery in combination.

Part V is a concrete exemplification of the principles laid down in the rest of the book. The battle of Wörth furnishes the military situations, and the conduct of modern artillery under the old circumstances is considered.

While a few parts of this book have been selected as the most striking, none can be disregarded as unimportant. This is a noteworthy book, which any officer, whatever his arm, may read with pleasure and profit.

Probabilité du Tir.—Captain S. Burileano, Roumanian Artillery. Paris, C. Doin & Fils, 1911.

Another new volume of the *Encyclopédie Scientifique*, combining a mathematical treatment of the theory of probabilities with a full discussion of its application to the subject of fire from cannon and small arms. The first two chapters are devoted to the general theory; and for the benefit of the reader who is looking for results, not methods, a nontechnical summary is placed at the end of each chapter. Chapter III deals with the probability of fire. An appendix gives an application of the theory of probabilities to the establishment of standards for the inspection of manufactured articles,—here, bullets for the infantry rifle.

Interior Ballistics.—Col. James M. Ingalls, U. S. Army, Retired. 3d Edition. New York, John Wiley & Sons, 1912.

The second (1894) edition of this standard text book being exhausted, Colonel Ingalls has been induced to prepare this new one. The first two chapters contain the matter of the first three in the old edition, modified by omitting some things that have become obsolete or unimportant,—notably many details about old gun powders,—and adding new matter concerning smokeless powders. The rest of the book has been entirely rewritten, incorporating the matter published in Volumes 24, 25 and 26 of the *Journal of the United States Artillery*. The preface to the new Edition notes an article in the *Journal of the Royal Artillery*. Volume 36, No. 9, in which Captain J. H. Hardcastle, R. A., says of certain formulas, here given in Chapter IV,—"after many dozens of calculations. I can find no serious disagreement between the results of calculation and experiment."

Die Artillerieverwendung im Feld- und Gebirgskriege.—Maj. Gen. Baron v. Lütgendorf. Vienna, Seidel & Son, 1912.

This is a small handbook, arranged for easy reference, and treats the subject of artillery tactics from the standpoint of the troop leader. Only elementary principles are given, with little attempt at their development. The book is evidently intended for officers of other arms seeking to gain an insight into the powers and limitations of artillery, and the proper methods of handling batteries that may come under their command. It is of course written with special reference to the Austrian service, but, from the very fact that it deals with fundamental principles and does not go much into detail, it would be useful anywhere.

Etudes Tactiques d'Artillerie.—Captain M. Blaise. Paris, Librairie Chapelot, 1911.

As its name implies, this is not a treatise on artillery tactics, but a series of essays. The writer takes up a number of separate questions, discusses them briefly, and then works out on the map a tactical situation or two, illustrating the points made in the discussion.

The first question is *convergence of effort*. The great advantage of convergent fire is pointed out, and the argument goes to show that it can generally be secured. In one of the illustrations, three groups of batteries are formed to fire upon four inferior hostile groups; the fire of each of the three groups is subdivided, and each engages at least three of the enemy's groups. The method of control is not taken up.

The *organization of command* is next taken up. Several illustrations are given, showing greater or less centralization; in one case the orders of the various artillery commanders are worked out in some detail. The general conclusion is for all the centralization that is reasonably practicable, the artillery commander organizing his battery groupings and giving their commanders only such independence as is necessary.

For the chapter on *foresight*, the maxim that "to command is to foresee" is the text. It is shown that the use of artillery, in particular, must be foreseen and arrangements made beforehand; "if it does not get there in time it will not get there at all,—the enemy's guns will see to that." At the same time the danger of premature or faulty engagement is not overlooked; in fact, it is insisted upon as emphasizing the necessity of foresight,—of *careful and accurate* foresight, exercised not only at the outset but at every moment of the action. Hope is expressed for help in this from aeroplane observers.

In treating the *combination of the arms* the writer expresses a fear that the system of intercommunication of the arms and assignment of artillery to detachments may go so far as to jeopardize the success of the general plan. He urges that artillery be detached only when absolutely necessary; that habitually it should be assigned to *support* a given force or movement, remaining under the *command* of its own chief.

Short chapters on *reinforcement*, and on a few special cases, complete a very interesting little book.

Einführung in das Heerwesen: Volume 5,—Artillerie.—Captain Otto Waldschütz, General Staff. Vienna, Seidel & Son, 1911.

This book is one volume of a very comprehensive work, intended to explain the military machine to the layman. It commences with a discussion of the general principles of artillery organization and equipment, then takes up the development and present situation of the Austrian artillery. The first part would be of little military value, as all the information is easily obtainable elsewhere; but the book is useful to anyone desiring information, in convenient shape, on the Austrian artillery.

Die Taktische Verwendung der Schwere Artillerie.—Captain Hans Friederich, Bavarian General Staff. Berlin, R. Eisenschmidt, 1912.

The larger part of this book is devoted to discussion of a series of

tactical situations, on the Metz map, involving the handling of the heavy artillery battalion of an army corps in active field operations. Beginning with the corps orders, the situations are worked out to include the detailed instructions of the battalion commander for occupation of position, etc. Some attention is also given to artillery officers' patrols. There are chapters dealing with the general principles of the use of the arm, ammunition supply, administration, and a comparison of the French and German heavy artillery systems.

Telephone and Signal Communications for Field Artillery.—Lieutenant Dawson Olmstead (F. A.), Signal Corps. Washington, Signal Office, 1912.

This new edition of the signal manual for field artillery has been entirely rewritten and greatly expanded, and is a very complete and valuable treatise on the regulation matériel and its use. It describes first the general scheme of field artillery communication, from the brigade down to the battery. Next is given a list of the matériel issued. A brief explanation of the theory of the telephone serves as an introduction to a detailed description of the service instrument, its use and tests. There is also a description of the different types of field glasses and minor equipment, and a chapter on visual signalling.

Lehrbehelf zum Studium des Artillerieschiess- und Waffenwesens.—Captain Oskar Hofman. Vienna, L. Beck & Son, 1911.

An elementary treatise on artillery, for officers of all arms, prepared for use in officers' schools. It is useful in that it contains many details of Austrian matériel and methods, with photographs and diagrams, all conveniently arranged.

Le Millième et ses Applications Militaires.—General Alexandre Percin. Paris, Librairie Chapelot, 1911.

Artillerymen are all familiar with the utility of the mil as a means of passing from angular to linear measure, and know how useful it is in countless ways. But, strange to say, officers of other arms have been content to leave it almost the exclusive property of the artillery. This pamphlet is an attempt to bring it to the notice of the service at large, in the hope that the term may become a part of the general military vocabulary.

BOOKS RECEIVED FOR REVIEW.

The following books were received at the moment of going to press; more extended notice will appear later.

Gunnery.—Captain Jennings C. Wise, Adjutant, First Battalion, Field Artillery, Virginia Volunteers. Richmond, Virginia: B. F. Johnson Publishing Co., 1912. (Advance sheets.)

Apparently an excellent elementary manual of gunnery for field artillery officers. To allow for differences in the preparation of those taking up the study, chapters on various branches of elementary mathematics precede those on gunnery proper.

The Rasp.—Class of 1912, Mounted Service School: Fort Riley, Kansas, 1912.

Not an ordinary "class book," but a serious treatise on horsemanship and riding schools.

FIELD ARTILLERY DIRECTORY.

REGULAR ARMY.

- 1st Regiment (Light).*—Col. David J. Rumbough: H. Q. and 2d Bn, Schofield Barracks, H. T.; 1st Bn, Manila.
- 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.
- 5th Regiment (Light).*—Col. Granger Adams: Fort Sill, Oklahoma.
- 6th Regiment (Horse).*—Col. Eli D. Hoyle: Fort Riley, Kansas.

MILITIA.

- 1st Inspection District.*—Lieut. Thomas D. Sloan, Inspector, Boston, Mass.
Massachusetts.—1st Bn, Maj. Charles F. Sargent: H. Q. and Btry C, Lawrence; Btry A, Boston; Btry B, Worcester.
Rhode Island.—Btry A, Capt. Ralph S. Hamilton: Providence.
Connecticut.—Btry A, Capt. Luther E. Gilmore: Branford.
- 2d Inspection District.*—Lieut. Harry Pfeil, Inspector, New York City.
New York.—1st Bn, Maj. Frank H. Hines: H. Q. Btries A and B, New York City; Btry C, Binghamton. 2d Bn, Maj. ———: New York City.
Separate Btry A, Capt. Guido F. Verbeck: Syracuse.
New Jersey.—Battery A, Capt. Harry L. Harrison: East Orange. Btry B, Capt. Samuel G. Barnard: Camden.
- 3d Inspection District.*—Capt. Oliver L. Spaulding, Jr., Inspector, Washington, D. C.
Pennsylvania.—Btry B, Capt. William T. Rees: Pittsburgh. Btry C, Capt. Charles H. Cox: Phoenixville.
District of Columbia.—1st Btry, Capt. J. H. Shannon: Washington.
Virginia.—1st Bn, Maj. T. M. Wortham: H. Q. and Btry A, Richmond; Btry B, Norfolk; Btry C, Portsmouth.
- 4th Inspection District.*—Lieut. E. P. King, Jr., Inspector, Atlanta, Ga.
Georgia.—Btry A, Capt. R. J. Davant: Savannah. Btry B, Capt. J. E. Eubanks: Atlanta.
Alabama.—1st Bn, Maj. L. S. Dorrance: H. Q., and Btry D, Birmingham; Btry B, Montgomery.
Mississippi.—Btry E, Capt. Dennis E. Hossley: Vicksburg.
Louisiana.—Louisiana Field Artillery, Maj. ———: H. Q., Btries A, and B, New Orleans.
Washington Artillery, Maj. Allison Owen: H. Q., Btries A, B, and C, New Orleans.
- 5th Inspection District.*—Capt. Charles M. Allen, Inspector, Cleveland, Ohio.
Ohio.—1st Bn, Maj. Harold M. Bush: H. Q., and Btry C, Columbus; Btry A, Cleveland; Btry B, Toledo.
Michigan.—Btry A, Capt. C. B. McCormick: Lansing. Btry B, Capt. ———: Lansing.
Indiana.—1st Bn, Maj. Frank E. Stevenson: H. Q., and Btry C, Rockville; Btry A, Indianapolis; Btry B, Fort Wayne.
- 6th Inspection District.*—Capt. Charles C. Pulis, Inspector, Chicago, Ill.
Minnesota.—1st Bn, Maj. George C. Lambert: H. Q., Btries A and C, St. Paul; Btry B, Minneapolis.
Wisconsin.—Btry A, Capt. P. C. Westfahl: Milwaukee.

- Illinois*.—1st Bn, Maj. Ashbel V. Smith: H. Q., and Btry C, Waukegan; Btry A, Danville; Btry B, Chicago.
- 7th Inspection District*.—Lieut. Frederick M. Barrows, Inspector, Kansas City, Missouri.
- Missouri*.—Btry A, Lieut. Eugene O. Sanguinet: St. Louis. Btry B, Capt. _____ : Kansas City.
- Kansas*.—Btry A, Capt. W. A. Pattison: Topeka.
- Texas*.—Btry A, Capt. F. A. Logan: Dallas.
- New Mexico*.—Btry A, Capt. M. S. Murray: Roswell.
- 8th Inspection District*.—Capt. Dennis H. Currie, Inspector, Denver, Colo.
- Colorado*.—1st Bn, Maj. J. B. Goodman, Jr.; H. Q. Btries A and B, Denver.
- Utah*.—1st Btry, Capt. W. C. Webb: Salt Lake City.
- Oregon*.—Btry A, Capt. Hiram U. Welch: Portland.
- California*.—Btry A, Capt. Reuben A. Ford: Los Angeles. Btry B, Capt. Ralph J. Fancuf, Oakland.
- Unassigned*.
- New Hampshire*.—Btry A, Capt. Edwin L. Towle: Manchester.

ACTIVE MEMBERSHIP PERCENTAGES, FIELD ARTILLERY ASSOCIATION.

3d Regiment	97
Unassigned officers, U. S. F. A.	95
4th Regiment	89
6th Regiment	81
1st Regiment	79
2d Regiment	76
5th Regiment	76
5th Militia District	63
1st Militia District.....	57
3d Militia District	47
2d Militia District	45
8th Militia District	39
6th Militia District	32
7th Militia District	32
4th Militia District	19

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.