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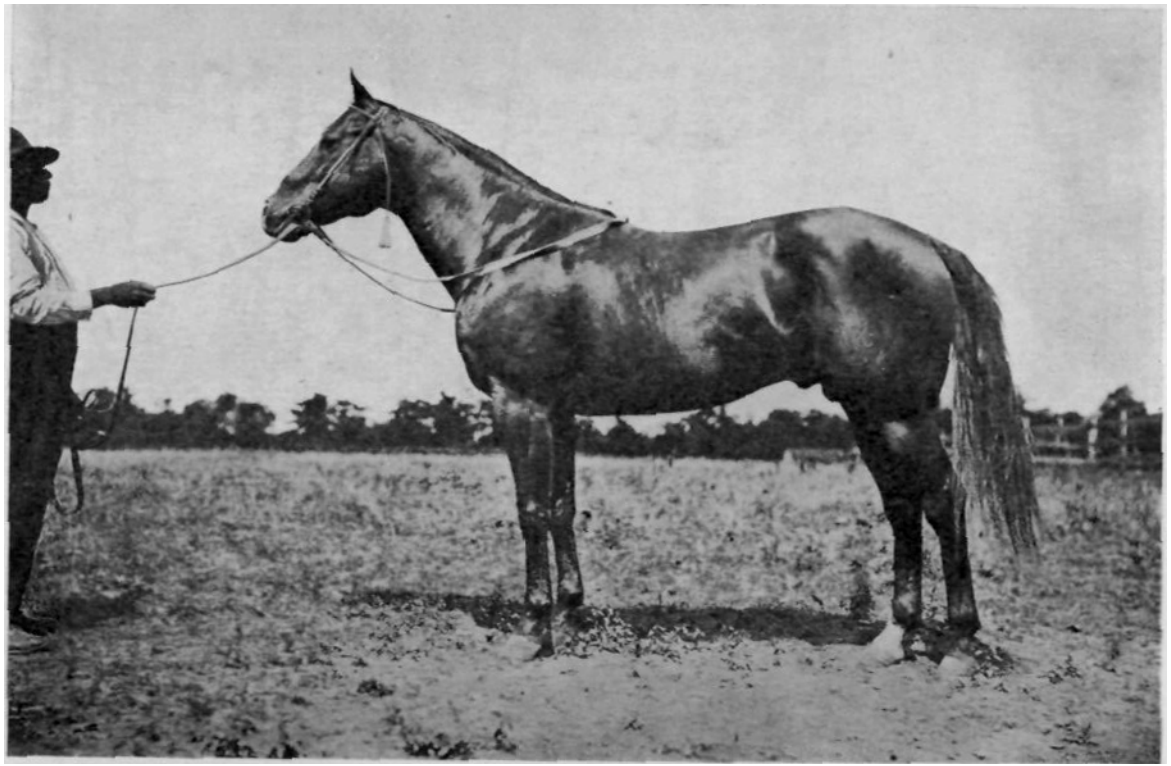

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The Field Artillery Journal

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FIELD SERVICE EXERCISES FOR A BATTALION OF LIGHT ARTILLERY

BY G. AUBRAT, MAJOR OF FIELD ARTILLERY.

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(CONTINUED FROM JUNE NUMBER.)

LECTURE NO. 4.

The Methods of Fire.

It is the business of the battery commander to apply the various regulation methods of fire so as to get the best results in each particular case. These methods are as follows:

Fire by piece.—The designated piece may fire single shots or volleys, with or without sweeping, at one or more ranges, or may use zone fire with or without sweeping. It may use a corrector giving either normal or one-mil bursts.

Fire by several pieces.—The pieces designated do not necessarily belong to the same platoon. They may fire either independently or together, in any of the ways indicated for a single piece.

The various methods may be used separately or in combination. Thus a battery salvo may be immediately followed by zone fire with a single piece. Zone fire by a platoon may be superposed upon continuous fire by the other platoon. Adjustment to a 200 meter bracket may be followed successively by zone fire, a readjustment shortening the bracket to 50 meters, a volley, adjustment by piece

to a 25 meter bracket, and finally fire by piece for demolition. Here three kinds of fire have been used,—zone fire, volley, and percussion fire by piece.

It will be seen that the number of possible combinations is very great; and we are thus led to inquire how the captain is to make his choice among so many solutions. Each of the circumstances making up any concrete case,—the battery's orders, its target, its position, the method of preparation of fire,—has an influence upon the selection; and the captain must find a solution appropriate to all the circumstances, giving each its proper weight. This looks complicated at first sight; but practically there is always some one consideration that so far outweighs the others that the choice is not difficult. Thus, the mere fact that the captain wants to get an effect of demolition, destruction or neutralization, comes very near to controlling his selection of a firing method. This will readily be seen from a few illustrations.

Fire for demolition.—Suppose the captain wants to get an effect of demolition. This is essentially a fire of precision. It should be executed by single shots, each burst being separately observed. This alone, then, determines the kind of fire to be used,—it should be by piece. Everything else is secondary. Thus, if the object is to demolish hostile guns, which have already been completely silenced, the fire can be deliberate and continuous. If, on the contrary, the enemy's guns open fire again, the fire for demolition is interrupted, a volley or two fired, and then deliberate percussion fire taken up again.

Fire for destruction.—In this case, the captain will reason somewhat as follows:

"I want to get such and such an effect; that is, about such a per cent of hits. To do this, I must fire with a density of so and so,—one, two, three, etc., projectiles per meter of front. The total front of the target is so many mils, equal, at this range, to so many meters. To get the desired effect I must use so many pieces, each firing so many rounds. The zone of indecision is so and so; the fire must then be repeated at such and such ranges."

This reasoning applied to any particular case at once limits the choice of firing methods. Thus, assume a battery in observation, pieces directed upon the center of its sector, whose front is 70 mils. The firing data have been determined. The mean range is 2,500 meters; the zone of indecision, limited by two prominent marks, is

from 2,400 to 2,600. The distribution difference is 10, the angular value of 25 meters at this range.

Under these conditions, the battery can completely cover a front of 100 meters, with a density of 4, 8, 12 or 16, according as the guns fire one, two, three or four rounds. If the front to be covered is 75 meters or less, the captain will use only three pieces; if 50 meters, two pieces; if 25, one piece. If the front is more than 100 meters, and it is necessary to cover it all at once, the fire must be more divergent.

Suppose now that various targets appear in the sector of observation. First, a line of infantry moving at double time is seen in the left part of the sector; its front is equal to about half the width of the sector,—say 40 mils. The captain commands:

"Volley fire two rounds; add 20; range 2,500."

Next, a battery takes position in the center of the sector, a little beyond the zone of indecision. The captain commands: "Second and third pieces, volley fire two rounds, range 2,600," and follows this volley immediately by another at 2,700. A simpler plan would be zone fire by the whole battery, range 2,600; but this would mean expending thirty-two rounds instead of eight.

Again, we may assume the battery in observation, pieces anchored, with a distribution difference giving each piece a fourth of the target front; if the front is 120 mils, this difference will be 30, and each piece will be directed upon the center of its 30 mil front. The ground has been registered by fire; 3,000 meters is the range to the opposite crest, and 3,400 to the line of flash defilade. We know that at 3,000 meters a front of 25 meters is equal to 8 mils, or four turns of the traversing hand wheel; to get bursts 25 meters apart will require "sweep by four." The captain has studied the ground, and has fixed in his mind the sector covered by each piece. A battery salvo will give bursts 90 meters apart.

Targets now begin to appear. First is infantry, in two small columns, in the right half of the sector. The captain commands: "No. 1 subtract 15; No. 2 add 10; volley fire two rounds, corrector 19, range 3,000." The volley is short, bursts low. The next commands are: "Volley fire two rounds, corrector 21, range 3,100."

A line of infantry is seen, covering the whole sector of the third piece and half that of the fourth. The captain commands: "No. 3, volley fire five rounds, sweep your whole front; No. 4, three rounds, the right half of your front."

Gun flashes are seen, and shrapnel fire is opened upon our infantry; it is necessary to silence this artillery at once. The flashes cover a front of 20 mils, in the sectors of the second and third pieces. The captain commands: "No. 2, volley fire three rounds, sweep to the left; No. 3, three rounds, sweep to the right; range 3,200." The same fire is immediately repeated at range 3,100.

To take still another case, assume a battery in observation, with flash defilade with respect to the sky line. The pieces are not anchored. Fire for registration has shown the opposite crest to be at range 3,700, a hedge in front of it 3,500, and the line of flash defilade 4,000. By reason of the high defilade, the battery is undisturbed by the enemy, and can make all its preparations at leisure. Suppose the distribution difference 6 mils, and the sheaf directed upon a conspicuous registration point.

Various targets now appear. The first is a line of infantry, crossing the sky line and descending the slope. The captain turns his sheaf upon the center of the line, anchors, fires a salvo to verify his direction and range, and then takes up volley fire. His commands would be somewhat as follows:

"Add 250; anchor; corrector 20, range 3,600"; followed by "Volley fire two rounds; subtract 20; corrector 22; range 3,700."

The battery here covers completely a front of 100 meters. If the captain has reason to fear that the target is about to disappear, he may fire without anchoring.

A column now crosses the sky line and descends the slope. The captain commands: "Add so and so; anchor; corrector 20; range 3,500." Finding his second piece in the proper direction, he adds: "No. 2, zone fire; corrector 22; range 3,500."

The distribution difference 6 was selected so that the battery could, at this range, cover completely a front of 100 meters. If a broader front is to be covered, the fire will have to be sweeping. For instance, if the distribution difference were 12, each piece would have to be fired in two directions, traveling 6 mils, or three turns of the wheel, between shots.

We have, then, seen that there may be four distinct methods of placing a battery in observation: the sheaf may be formed so as to cover its front completely, or it may be opened out so as to necessitate sweeping; in either case, the pieces may be anchored at the outset, or anchoring may be postponed until the target appears. The examples show that the method of fire for effect to be adopted

depends chiefly upon the method of installation chosen, and that there is no difficulty in fitting the method of fire to the target. Hence the captain must comprehend clearly which method of installation is best suited to the particular case; for when he has chosen his method of installation, his method of fire follows naturally.

The pieces should not be anchored at the outset unless the front to be observed is narrow. Fire without sweeping may be used if the front of the target does not exceed 100 meters plus 25 mils on each side,—that is, 100 mils at 2,000 meters, or 75 at 4,000. With sweeping, a front of 50 mils for each piece, or 200 mils in all, may be covered at any range. If the pieces are not anchored at the outset, the front to be covered does not matter.

The distribution difference depends primarily, of course, upon the front to be covered; but it may be said that it should be such as to make the sheaf cover 100 meters if the targets expected are few but important, and greater if they are broad and scattered, but less important.

We have not discussed the case where fire for effect is to be taken up immediately after adjustment, for the reason that this condition sometimes makes it necessary to use the most convenient method of fire for effect rather than the most suitable. Thus, if adjustment has been with a distribution difference of 15 mils at 3,500 meters, giving 50 meters between bursts, the same distribution may at times be used in the fire for effect, merely to save time; or again, for the same reason, fire for effect may be taken up at 1,800 meters with a distribution difference of only 10, giving an exaggerated density of fire.

Fire for neutralization.—Suppose now that the captain wants to neutralize some hostile element; his reasoning will be:

"I want to get such and such an effect of neutralization. I must, then, distribute my shrapnel bullets over such a front, or over such an area, without gaps, or with such and such gaps. Hence I must use such and such distribution differences, and such and such ranges, at particular moments, or for a certain period at a certain rate."

To illustrate, suppose that the battery is expected to keep down the enemy's fire absolutely, on a given front and for a given time. The captain will use continuous fire at a specified rate, spacing his projectiles 25 meters apart along the front. If he has to cover

an area instead of a line, he will do the same thing, spacing his projectiles 25 meters in breadth and 100 in depth.

If the object is simply to harass the enemy, reducing the volume and accuracy of his fire, the captain will reduce the rapidity of his fire, or space his projectiles more widely.

Again, the battery may fire only when the enemy exposes himself, to move or fire. In this case, the effort will be to destroy the enemy in detail, and one of the methods described for fire for destruction will be applicable.

If both neutralization and destruction are called for, there must be a combination of the two methods of fire,—continuous fire at a given rate, and volley fire. The captain may interrupt his continuous fire to deliver volleys, or he may divide his battery, keeping up a continuous fire with part of his guns and holding the others ready for volley fire as required.

It will thus be seen that the problem of neutralization is simple enough technically; the difficult part is to suit the method of fire to the nature of the target. To get results in fire for neutralization, the guns must be anchored; the battery takes its position in observation precisely as if the object were fire for destruction.

A few examples will clear up the matter.

1. The battery is called upon to neutralize a certain hostile force, on a front less than 200 mils. The circumstances are such that the whole front has to be covered. The firing data have been determined.

The battery takes position in observation, using a distribution difference such as to give each gun a quarter of the front; assuming the whole front to be 140 mils, and the range 3,000 meters, the difference will be 35. Taking the front covered by a shrapnel as 25 meters, the shots must be spaced 8 mils, or 4 turns of the traversing wheel, apart; that is, each gun must fire five shots to cover the front allotted to it. The captain, then, will command: "Continuous fire, 5 rounds, sweeping by four turns, interval 5 seconds." Then, when it is time, he has only to add, "commence firing." If necessary, each gun may be given a different range, to allow for obliquity of the enemy's front. Such fire would be properly used against a trench, or the edge of a wood or village.

If the fire is with shell, the range should be determined within 25 meters for each piece; the series should be two rounds only, sweeping by eight turns instead of four, since the shell fragments cover a front of 50 meters.

2. The target is a battery, whose flashes only are visible. It is required to neutralize it, to such an extent that it can not fire at all for a certain period. The firing data have been determined, the front is 30 mils, and the zone of indecision is such that three ranges must be used,—2,900, 3,000 and 3,100.

The battery takes position in observation, forming the sheaf with a distribution difference of 8. The captain gives the following instructions:

"Continuous fire by piece, one shot per gun per minute; ranges, 2,900, 3,000, 3,100; 1st platoon begin at 2,900, 2d at 3,100. Commence firing."

3. The battery has orders to keep down the fire upon our infantry from hostile skirmishers along the edge of a wood. The front is about 350 mils. Fire has been adjusted upon the edge of the wood; the mean range is 2,500 meters.

The battery takes position in observation, forming the sheaf with a distribution difference of 90 ($\frac{350}{4}$ = 87) and anchoring the pieces; each piece uses its own range, according to the form of the woods.

It should not, however, be anticipated that the battery can thus cover absolutely the whole front; there are bound to be gaps. Using the maximum traverse on the axle, a piece can sweep 50 mils on each side of the normal; hence if the direction is perfect when the guns are anchored, the front covered by the battery may be as high as 400 mils. But the direction is never perfect; experience indicates that one can not count on having a useful traverse of more than 25 mils on each side of the normal. That is to say, when the guns in this case have been anchored, it will undoubtedly be found that the 100 mil sectors theoretically possible to the separate guns will not precisely meet; most of the front will be swept by some piece, but certain parts will be swept by two, and others will not be touched at all. This will be unimportant in a case like this, for it is not necessary that every meter of the front be kept under fire.

Instructions having been given to sweep by five turns, the captain needs only to command, as required by the situation:

"One shot per gun every four minutes: commence firing."

"Six shots per gun per minute: commence firing."

"Cease firing."

"One shot per gun per minute: commence firing."

4. The battery is required to keep down the fire of hostile artillery,

whose flashes only are visible on a front of 25 mils, and which is preventing our skirmish line from advancing.

The battery takes position in observation, using a distribution difference of 8, the range being about 3,000 meters. Fire for registration of the ground in rear of the enemy's mask indicates that the correct range is between 3,000 and 3,200. Since at this range three guns can completely cover 25 mils, one piece is ordered to take no part in the fire.

The next time the hostile artillery fires, the captain fires a volley at 3,000, with the corrector determined during the fire for registration. The hostile artillery fire ceases, but begins again in a few moments. This time he fires a volley at 3,100; the third time at 3,200. When the skirmish line starts forward again, he fires at 3,000, so as to have his projectiles reach the hostile position at the instant a volley is fired at the skirmishers. The three ranges are used in succession, and the captain has at least one chance in three of getting effective volleys.

Fire for both neutralization and destruction.—A battery is ordered to make preparations to neutralize, whenever required, a trench whose front is 90 mils. The captain first adjusts his fire; he finds the range to the left end of the target 2,500, and to the right end 2,400; that corrector 19 gives a normal burst; and that certain conspicuous points are at certain distances in front and rear of the trench. The front being only 90 mils, and neutralization only being called for, the first platoon is assigned for this purpose, and the second is held in readiness to destroy any force that may appear outside of the trench.

The two pieces designated to fire upon the trench are given a distribution difference of 45, and anchored. Each can then cover half the front, by firing five rounds, sweeping by 10 mils, or five turns of the wheel. The other platoon remains in position, using the same distribution difference as the first; but the captain retains direct command of it, while he gives only general instructions to the first. He notifies the chief of the first platoon when he wishes fire for neutralization to commence, and the chief then conducts the fire, regulating its rapidity or ordering temporary cessations. When, by observation of his registration points in front of the trench, the chief of platoon thinks his fire is becoming dangerous to the advancing infantry, he changes to percussion fire, lengthens his range, and finally, resumes time fire at a longer range.

Meanwhile the captain, with the second platoon, fires upon any troops that may expose themselves in the vicinity of the trench, judging his ranges by observation of his registration points.

Such elaborate preparation of fire as we have outlined may appear too complex, but it is justified by two considerations; first, the captain always has plenty of time to prepare for fire for neutralization, and secondly, it is exceedingly important to make every effort to keep down the expenditure of ammunition.

LECTURE NO. 5.

Fire upon a Registered Area.

We will first discuss briefly the general subject of this method of fire, and then give a detailed solution of the problem of preparation for it in the most complicated case.

We will assume a battery in observation of a very broad and deep sector; no firing data whatever have been determined. We will follow all the steps to be taken by the battery commander to secure the necessary data, and to make use of them promptly upon the appearance of a target. Finally we will inquire in what respects this procedure may be simplified in ordinary cases,—that is, where the sector of observation is small and some information has been obtained by previous firing.

General Considerations.

A battery in observation is said to have registered the ground when it has, within its own sector, determined the configuration of the ground, and the firing data for a number of conspicuous points.

By determination of the configuration of the ground is meant a careful study of ground forms, especially of such features as might be used for cover. Conspicuous points are, first, such as might conceal the enemy,—walls, hedges, ditches, crests, etc.,—and secondly, landmarks which might help in estimating ranges to targets appearing in their vicinity,—groups of trees, isolated houses, etc.

When an area has been registered, the battery can in many cases dispense with fire for adjustment and open fire for effect as soon as a target appears. Fire for adjustment is necessary only if there are no landmarks near the target, and this is never the case. Such

marks are often not to be found on firing grounds, but in ordinary country they are always numerous enough and near enough together to permit of estimating ranges within 200 meters, which is near enough to justify fire for effect. The approximation may be made closer in the course of the firing.

Registration is, then, a means for expediting adjustment, or avoiding the necessity for it altogether. It is an extension of the preparation of fire, saving valuable time at the instant of commencing fire, and reducing the expenditure of ammunition. From this one might conclude that the ground should always be registered; but there are certain disadvantages that must also be considered. Fire for registration reveals the presence of artillery, and gives more or less indication of the intentions of its commander; and hence such fire would often be a mistake.

In general, the objection to revealing the presence of the artillery holds chiefly at the beginning of the action. When the guns have opened fire the objection disappears; and this is usually the time for registration. Not only is there no longer any reason why it should not be done, but observation of the previous fire makes it easy to do.

Fire for registration will usually be done during the long pauses in the artillery action. Incidentally, it will serve to keep up the continual roar of artillery, which has always proved so encouraging to the troops engaged; when the 75 mm. gun was first adopted, many officers expressed the fear that the new guns would not make themselves heard throughout the battle.

Formerly, fire for registration was never heard of, for two very good reasons. First, with the old laying methods, the process would have been very slow; and secondly, even after it was completed, the guns could not utilize the information gained without some delay. But all this is now changed; with the 75 mm. gun projectiles may be placed easily and accurately at any desired point, so that registration is perfectly practicable; and by means of collective laying fire may be brought almost instantaneously upon any target that appears within the registered zone. It is today universally recognized that fire for registration is necessary; practical experience with the 75 mm. gun has shown how easily it may be done, and General Langlois' analysis of the problems that artillery must solve has explained the necessity.

Today's lecture will explain a process of preparation of fire upon a registered zone. This procedure has not been practically tested in all its details, but the regulations say so little on the subject that it seems desirable to lay it before you. It is not proposed as a final solution of the problem, but merely as one step toward such a solution.

The object in view is, to permit fire to be opened upon any target, as soon as it appears, with the same effect as if adjustment had been made upon it. Hence the captain must have his firing data at the guns within a few seconds after the appearance of the target, and must know approximately how deep a zone he will have to cover. If for any reason fire for adjustment can not be entirely omitted, at least it must be greatly expedited.

This fire requires three operations: preparation of fire, registration, and fire for effect. The preparation of fire includes all the operations intended to get the battery on the target, and particularly the determination of deflection and angle of site. Registration consists in determining for various targets the corrector, initial range and required depth of zone. Fire for effect commences after the captain has all his firing data for the various targets; these data are in part determined by the fire for registration, and, if necessary, a verifying salvo is used.

Preparation of Fire.

The procedure of a battery taking position to fire upon any target that may appear within an area of considerable depth is very similar to that adopted where the target is expected to appear from behind a crest.

Deflection.—To get the deflection, the battery forms its sheaf of fire with its right gun directed upon some clearly visible reference point. When the target appears, the captain measures the angle between his reference point and the right of the target, and increases or decreases his deflection so as to bring the axis of his sheaf approximately in line with the center of the target. The pieces may or may not be anchored, and the distribution difference may be large or small, according to the front to be observed, the range, and the tactical situation.

Angle of site.—When a battery is to fire upon a certain definite position, the proper angle of site for the target is given, once for

all, to the guns; but this is not possible when a zone of considerable depth has to be observed. What, then, is to be done,—should different angles of site be used for different parts of the zone? This does not seem advisable, for changing the angle of site with the matériel now in use requires some little time; it would be much better to use a constant angle of site, and vary the corrector setting so as to get bursts at the desired height. This constant angle of site should be such that the bursts may be brought to the normal height by a change of corrector, no matter at what part of the zone the target may appear.

Consider the vertical plane passing through the battery and the center of the sector of observation. Let A (Fig. G″) be the battery, and BC the profile of the ground. The angle BAC, expressed in mils, represents the height of the zone.

1. Assume that this angle is less than twenty mils, which is a very common case. If we take the angle of site of any point within the zone, then theoretically the limits of the corrector scale are sufficient to permit getting a one mil burst anywhere. Practically, however, we can not count with certainty upon getting this result if the height of the zone is more than ten mils.

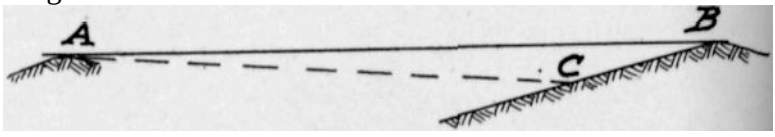


Fig.G.″

2. If the angle is greater than ten mils and less than twenty, we should take the angle of site of some conspicuous point M near the middle of it, so that the angles BAM and CAM (Fig. H″) are about equal.

3. If, by rare exception, the angle is greater than twenty mils and less than forty, two angles of site must be used, one for the upper half of the zone and one for the lower.

Registration.

The captain having directed his right gun upon a reference point, and selected his distribution difference, he can turn his sheaf of fire at once to any desired direction in the sector of observation. When now he has given his guns a constant angle of site, what more remains for him to do?

He must make such preparations that he can select instantly, upon the appearance of a target, the proper corrector, initial range and depth of zone.

The first plan that occurs to one is to adjust the fire upon a few

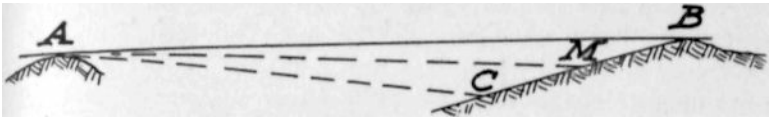


Fig.H."

conspicuous landmarks; and, if enough suitable landmarks are to be found, this is one solution of the problem. Suppose, for example, that the captain has determined, or had his lieutenants determine for him, the firing data for certain prominent landmarks, and that he has tabulated them as follows:

Landmark.	Bracket.	Corrector for one-mil burst.
Crest (upper limit of zone)	2300-2500	25
Edge of cultivated field	1900-2000	21
Hedge (lower limit of zone)	1600-1700	18

If the ground slopes down toward the battery, or if the battery position dominates the sector, so that the ground can all be seen, then upon the appearance of a target anywhere between the crest and the hedge the captain can at once estimate the necessary firing data and open fire for effect. But, aside from other objections, this procedure is very wasteful of ammunition. Even in the very simple case assumed, six adjustments are required, three in range and three in height of burst,—or, if we suppose the adjustment on the hedge to be made with time fire, five. This solution, then, is not satisfactory.

The second plan to suggest itself is to adjust in range with only one piece, and then determine the corrector for one prominent point; the corrector for any other point may then be determined by noting the difference in angle of site. This plan requires only four adjustments, three in range and one in height. It is fully as quick and accurate as the other, and requires less ammunition. But both have serious disadvantages, which become evident as soon as the problem becomes at all complicated, as, for example, when the area under observation is large and contains a number of landmarks, or when the ground is rolling and much of it hidden from view.

In such cases it becomes apparent that both these methods of registration require a great deal of ammunition. Each landmark requires a separate adjustment, and in all this there will be a great many lost rounds; and besides, neither method gives any information as to the folds in the ground, which are often used to conceal troops, and whose range it is desirable to know. Thus, in the case outlined, neither method of registration gives any information as to the ground behind the crest, which is essential if occasion arises to fire upon troops moving under cover there.

The method to be adopted must be such that not only the range to the crest may be determined, but also the form of the ground in rear of it. The third method consists in constructing a scale on the ground, by firing a series of percussion projectiles with ranges increasing by 100 or 200 meters. This plan is believed to be preferable to the others in all cases, whether the problem in hand be simple or complicated. It gives a general idea of the form of the ground, and greatly facilitates the subsequent adjustment upon various landmarks. The scale being constructed, the captain determines a corrector, and then gets the range to important points if he thinks the information previously gained is insufficient.

The first series of shots is fired with a single piece, and not more than two shots are fired at any one range until the series has been completed. The shots need not all be in the same direction; in fact, it is preferable to vary the direction enough to bring the points of burst into some observable relation with the selected landmarks. The captain notes all the information gained on a form something like the following.

Angle of Site_____			
Profile of ground.	Landmarks.	Range.	Corrector.

In the second column he places dots or crosses to indicate the points of fall of his successive shots, and notes opposite them the ranges. Between these he marks the positions of his landmarks, designating them by names or rough sketches. If shots are lost in folds of the ground, he draws a rough profile in the first column. To make this table easy to read, the ranges should decrease in regular order from top to bottom.

This firing being completed, the captain decides whether or not to make a more complete adjustment upon certain ones of his landmarks, and selects one of them for determining his corrector. In this he can be assisted by his lieutenants; he points out to them the objectives upon which they are to adjust, and gives them the initial ranges. The range and corrector for each point is then entered opposite it in the table, which thus enables the captain to open fire instantly upon any target that appears in his area. In most cases he will have the ranges within 100 or 200 meters, and can fire for effect without preliminary adjustment.

Adjustment in range may be made with either percussion or time fire. Percussion fire is always by piece, not only to save ammunition, but also because the maximum amount of information can be secured from each shot, when the officer conducting the fire has only one at a time to observe, and knows in exactly what direction to look for it. This kind of fire is always used when the registration is upon some point of the ground itself, or something very low, or when it is desired to register ground behind cover. The captain may prefer to use time fire for certain parts of his area, where the landmarks are of considerable height. Time fire is usually by platoon rather than by piece; it gives the range less accurately than percussion fire, but has the advantage of giving both range and corrector. In some cases both kinds of fire may be used,—time fire for rough adjustment, and percussion afterward.

Fire for Effect.

With a given target, and with the same ground and the same military situation, fire for effect can not always be conducted in the same manner, as will be clear from a moment's reflection. If there were no other reason for differences in method, the mere fact that there has been no adjustment, but merely registration, would be sufficient; for the degree of confidence that the captain has in his initial firing data varies. The mechanism of fire will always be the same, but the details will change according to the circumstances of the particular case.

After adjustment, all the firing data are perfectly known, because they have been determined by actual experiment. After registration, the circumstances are very different. We will examine these differences, for each item of the firing data,—deflection, corrector, range, and depth of zone to be covered.

Deflection.—The conditions are much the same as those described in a previous lecture, for a battery taking position in observation with a view to fire for destruction.

We have indicated four different ways of taking position in observation; the captain chooses the one which is appropriate to the particular case, being guided by the principles that we have already deduced. But one question that it will be of interest to discuss is, whether or not a verifying salvo should be fired. If it is, the fire for effect will probably be better directed, but, on the other hand, the effect of surprise produced upon the enemy will be less.

The answer to this question depends upon the circumstances of the particular case. If the salvo is fired, it is always with a low corrector and with the range which seems to give the best promise of effect. The fire for effect to follow it may be with all the guns or only a part, according to the front of the target; the captain changes the direction of his guns, or selects the ones to fire, according to the results of the verifying salvo.

Corrector.—The corrector sought is the setting for a one-mil burst. A battery which has registered its ground often has to fire with a corrector other than that which it has previously used; this will make the fire for effect less accurately adjusted in height than if there had been a complete adjustment, but it is not desirable to fire a verifying salvo simply to get the true corrector. It should be remembered that fire upon a registered area is always against troops in very vulnerable formations; hence the fire will always be sufficiently effective even if the bursts are a little too high or too low. After a verifying salvo, there is no need of changing the corrector unless the bursts are all on graze or their average height is over three mils.

Range, and depth of zone.—If the target is certainly at the same distance as some point upon which the battery has adjusted, the conditions are the same as if the target were the point itself. Adjustment having been made upon the point, the captain may proceed exactly as if he had obtained a bracket on the target.

If the target is between two such points, the captain takes his initial range and depth of zone according to its position with respect to them. The degree of precision with which he can estimate depends upon the distance between the points, the accuracy with which he has the ranges to them, and the facilities offered by the ground for judging the position of the target with respect

to them. He then decides, taking into consideration the information gained in registration fire, the military situation, and the nature of the target, as to the proper kind of fire for effect, and whether he should commence it at once, or fire a verifying salvo, or make a complete adjustment. If a verifying salvo is used, it should of course be fired with a low corrector, and with the range that seems most likely to give effect.

If the target is behind cover, the captain selects his initial range and depth of zone according to its probable distance from the mask. The situation is similar to that encountered in a case where, having adjusted on a crest, he tries to determine the zone of indecision of his target, either by finding the range to conspicuous points in rear of the crest, or, if no such points are visible, then by tracing a profile of the ground with percussion fire.

To sum up, fire upon a registered area includes the following operations:

Occupation of position in observation, according to one of the four methods already outlined: that is, the pieces may or may not be anchored, and the distribution difference may be small, so that the battery completely covers a front of 100 meters, or large, so that each piece has its own sector to sweep.

Determination and announcement of the constant angle of site.

Construction of a scale on the ground, by percussion fire with one piece, ranges diminishing by 200 meters.

Record of the information secured by this firing, in the form illustrated and described above.

Selection of a point upon which to determine a corrector, and points whose ranges are to be found more accurately.

Adjustment upon the points so selected, and measurement of differences in angle of site, for the purpose of estimating the corrector to be used for each point.

Completion of the record, by entering opposite each point the corrector and range for it.

Upon the appearance of a target, measurement of its angular distance from the point upon which the right gun is directed, and change of deflection accordingly.

Selection from the record of the necessary firing data,—initial range, corrector, and depth of zone to be covered.

Fire for effect, preceded if necessary by a verifying salvo.

From this summary it might be supposed that preparation for such fire requires a long series of more or less complicated operations; but this is only because we have traced the procedure in the most complicated case, and generally the number of operations will be much less. We assumed that the battery commander had no firing data at all. As a matter of fact, the battery would usually have done some firing before commencing registration; the captain would probably know, for instance, the firing data for a crest on the sky line, and would have some knowledge of the form of the ground behind it, from fire of his own battery or another near it. Often it will not be necessary to measure the angle of site; either it may safely be taken as zero, or it will have been measured during the previous fire and given to the guns. The construction of the scale requires only seven or eight rounds for the whole depth of the area; and more accurate determination of ranges to prominent points will probably require only seven or eight more.

To appreciate the flexibility of this method of registration, it will be sufficient to try it a few times in the field. It is not necessary, to form a first opinion, to try it by actual fire; it will be sufficient simply to ask our infantry comrades to show us a living example, by maneuvering their troops at will according to some tactical situation.

Of course, this preliminary work can not be completed by fire on an ordinary target range; variety of targets is essential, and, since for this work we must adjust upon points in the ground, we must have varied ground. We are thus forced to the same conclusion as in all our other exercises in preparation for war,—part of our firing, especially that upon masked targets and upon registered areas, must be done in the field.

Conclusion.

In this series of lectures, I have tried to give a few hints which will help you in solving firing problems in action.

I have advised that, first of all, you decide definitely what effect you want to get upon the target,—whether demolition, destruction or neutralization,—and that you then proceed to determine your initial firing data, fire for adjustment or registration, and make your preparations to open fire for effect at the proper moment. In this connection, I have given you a few notes on the effect of fire, and upon the proper use of the various firing methods.

After these lectures, are you better prepared to solve firing problems than you were before?

Theoretically, yes; but practically not until you have applied your theoretical knowledge by solving a number of such problems on varied ground. Firing problems should be as familiar to you as maneuver problems; the proper solutions should come to your minds automatically, without effort.

But when you get a firing problem, you should now be able after a little reflection to decide what effect you want to get, to proportion your ammunition expenditure to the object in view, and to select the proper method of fire. You will agree with me, that our time has not been wasted; and we may reasonably expect that, with a little practice, you will be able to solve any firing problem that may confront you on the battle field. Your solution may not be the best possible, but it will certainly be a good approximation to it.

EXERCISES WITH MATÉRIEL

(*with discussion in the field*.)

FIRST SESSION.

The battalion commander acts as director. One battery takes out its guns, the others are represented by mounted details. The first session is devoted to a conference in the field, the director announcing the problems and giving the solutions.

The officers and mounted details are assembled at the crossroads a hundred meters north of La Blaiserie, the battery remaining on the main Nantes-Poitiers road (Fig. I″.) The director gives out the following

General Situation. Two forces, Red and Blue, are advancing to meet each other. A battalion of artillery belonging to one force is ordered to take position to engage and neutralize the hostile artillery; the latter is now silent, but has been firing, and its flashes have been seen and their direction noted. The battalion is directed to take position in observation, unseen by the enemy, and await a favorable opportunity for opening fire.

Today's exercise will deal with the occupation of position by a Red battalion to fire upon Blue; in a later exercise we will take up the other side.

Description of the Ground. The action takes place between the main road from Poitiers to Nantes (Fig. I″), and the road, bordered

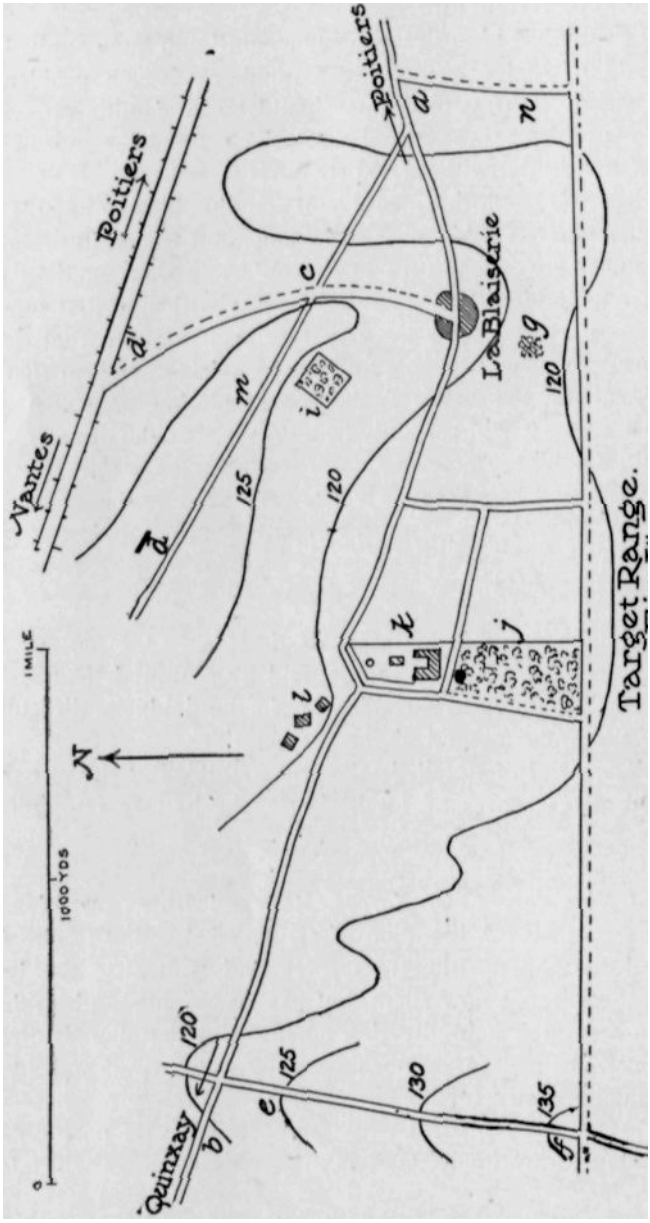

Poitiers
Poitiers
Nantes
La Blaiserie
Target Range.
Quinxay
1 MILE
1000 YDS
N
a
b
c
d
d'
e
f
g
h
i
j
k
l
m
n
120
125
130
135

Fig.I."

by trees, along the north boundary of the target range. The troops are marching by the road from Poitiers to Quinxay and Vouillé (*ab*, Fig. I″); Red is coming from Poitiers and Blue from Quinxay.

This road here (*cd*, Fig. I″) follows the crest to be occupied by the Red battalion. This other one (*ca′*) can not be seen by the enemy on the hills opposite, and permits us to move about in rear of the position without injuring crops. The ground between the two roads gives any desired degree of defilade up to three meters, and even more in some places. The road *ef*, marked here and there by walls, hedges and trees, runs along the crest which conceals the Blue artillery, and which is called Les Bournalières. The slopes behind both crests are very gentle, only about 1 on 100; for the distance between the lines of mounted and dismounted defilade is about 70 meters.

Special Situation. The Red infantry occupies a line from that clump of trees (*g*), through La Blaiserie (*h*), to the orchard enclosed by a hedge (*i*). The Blue infantry is in the woods to the west (*j*), and in the groups of houses north of them, L'Arnaye and La Cadoue (*k* and *l*).

Description of the Ground. When the battalion commander reaches the crossroads (*c*) he has before him the view shown in the panoramic sketch (Fig. J″).

Just in front of him is the military crest of the hill; to the left is the orchard (*i*), and still farther to the left La Blaiserie. A little farther away are the church tower of L'Arnaye (*k*), the tops of a few trees, and the roofs of La Cadoue (*l*).

In the distance is the Bournalières crest, which conceals the enemy's artillery. On this crest are houses, haystacks, trees, hedges, and a very conspicuous white house with a red roof,—an excellent point of reference. Beyond, on the sky line, are the St. Hilaire woods.

Measuring with his hand, the battalion commander finds the following breadths of front:

From the white house to the line of trees bordering the target range, 100 mils. From this point of view these trees form a continuous curtain, so that this may be taken as the extreme left of the enemy's probable positions.

From the same house to the middle and lowest one of three round-topped trees, 100 mils.

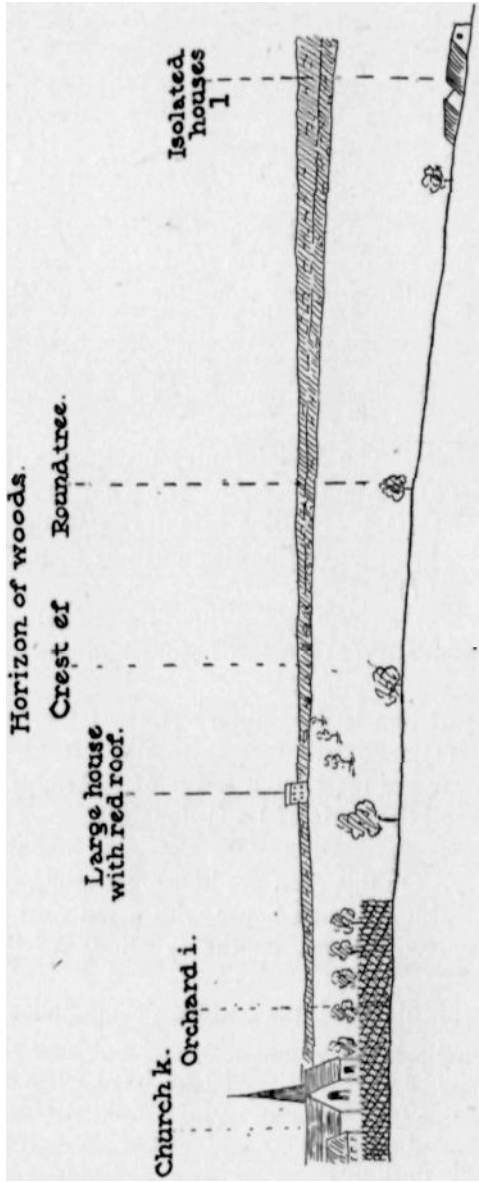

Horizon of woods.
Crest of Roundtree.
Large house with red roof.
Church k.
Orchard i.
Isolated houses 1

Fig.J."

From the tree to the right extremity of the enemy's probable positions, 200 mils.

The flashes of the artillery that has been firing upon our infantry were seen immediately to the left of the white house.

Solution. One of the first questions for the battalion commander to decide is the degree of defilade to be taken. Measuring the slope of his position, he finds it to be about 1 on 100; and sees that he can clear the crest in firing upon Les Bournalières, wherever he places the guns. But, considering the situation as it actually exists, he reflects that if he places them in front of the line of sight defilade against the white house, they will probably be demolished by the battery whose flashes were seen near there, and whose fire can easily be conducted from one of the windows. If he takes flash defilade against the roof of the house, the conduct of fire will become much more difficult, for the captains will have to come a long way ahead of the guns to observe.

It will be well to determine just where the various lines of defilade are. Take, in round numbers, 3,000 meters as the range to the Bournalières crest, and 15 meters as the height of the white house; 15 on 3,000 is equal to 1 on 200, and we already know that the slope of the ground at our own position is 1 on 100. With these figures, we find the following:

Distance from crest, meters	100	200	300	400	500	600
Defilade against Bournalières crest, meters	1	2	3	4	5	6
Defilade against roof of house, meters	0.5	1	1.5	2	2.5	3

The distances from the crest to the various lines of defilade are:

Sight defilade against crest, 130 meters; against roof, 260 meters.

Dismounted defilade against crest, 160 meters; against roof, 320 meters.

Mounted defilade against crest, 240 meters; against roof, 480 meters.

Flash defilade against crest, 200 meters; against roof, 600 meters.

The major determines a point of each of these lines, by the usual method of placing a mounted and a dismounted man where they can just see the roof of the house, and then measuring back from the position of the former a distance equal to that between the two, to find the line of flash defilade; he thus verifies his calculations. Then, having sufficiently studied the ground in profile, he studies the front.

With the mounted details, he goes along the road *cd′* to the main Poitiers-Nantes road. On the way, he points out that the crest is oblique to the direction of fire. This obliquity is very apparent when three men are posted on the line of dismounted defilade, one near each of the two roads just mentioned, and the third midway between them; it is at once seen that, with batteries in the positions so marked, the ones in rear could not fire without danger to those in front. The position being limited, on the right, by the form of the ground, and on the left by the vineyards between the crossroads and La Blaiserie, the interval between batteries can not be increased; the only thing that can be done is to move one flank battery forward and the other back.

This being understood by all, the major designates the positions for the three batteries: R′, on the right, barely concealed; R″, in the center, with mounted defilade; and R‴, on the left, with flash defilade. The battery which has brought its guns is assigned to the position of R′, which is close to the main road at a point where it runs through a small cut, and where the slopes give the personnel some protection.

Batteries R″ and R‴ take position at once, and prepare to fire. When they are ready, R′ moves into position. The defilade being slight, this last battery may be seen by the enemy, and therefore some precuations are necessary. The gunners come up to the position ahead of the battery; the drivers dismount, and come as close as possible without exposure; and the guns are then run up by hand. This plan is adopted for the reason that the ground is hard and the weather bright and clear; if the ground were wet and the weather dull, the captain might make all his preparations to fire beforehand, and then bring the battery into position rapidly, at a trot.

The next point to be discussed is the preparation of fire. Before taking this up, the major explains more fully the circumstances under which fire is to be opened.

The battalion is to await a favorable opportunity to fire; this opportunity will of course be when the hostile artillery again shows itself. This it may do by flashes, or by moving forward to the crest for direct fire. Preparation of fire is satisfactory if one or more batteries are in a position to fire at once whenever it does show itself.

For a battery to be able to open fire immediately, its commander must have his guns laid with the proper range, angle of site, corrector

and deflection; the nearer he can come to this, the quicker will be his action when a target appears. In this case, the enemy's position is known approximately, and each captain can give the range, angle of site and corrector; but the exact deflection can not yet be determined.

It would seem at first sight that nothing can be done in the matter of deflections, since the captain knows neither the direction of the target nor the breadth of its front; but some time may be saved by forming the sheaf beforehand. If we take a distribution difference that is neither too large nor too small, giving a density of fire neither too small for effect nor too great for economy, we can save the time required for hasty measurement of the front of the target after it appears. We know that at a range of 2,500 or 3,000 meters, a battery can effectively cover a front of from 30 to 45 mils, which means a distribution difference of 10 or 15 mils; with 15 mils the volleys should be sweeping, with 10 mils they need not be.

If, then, each battery forms its sheaf with a distribution difference of 10 or 15, the battalion will be ready to fire upon any artillery target at 2,500 or 3,000 meters range; the sheaf may be turned in the proper direction by adding to or subtracting from the deflection, without changing the deflection difference. If it is found that the distribution is too great, the captain may fire with only part of his guns, or close in his sheaf a little.

In practice, the process would be somewhat as follows:

The battalion commander, after giving his instructions for occupying the position, gives those for preparation of fire, in something like the following form:

"Range, 2,600; angle of site, plus 5; corrector, 18; reference point, right hand corner of that white house with a red roof; distribution difference, 15; report when your batteries are ready. I shall be on the road. Batteries will open fire in the order, 3d, 2d, 1st,—that is, the one with the highest defilade first."

Battery commanders transmit the firing data given by the major. In each battery the right gun is directed upon the reference point in any convenient manner, as, for instance, setting stakes in the line. In the first battery the guns are aimed directly at the reference point, the deflection setting of the first being *limb* 0, *micrometer* 100; of the second, *limb* 0, *micrometer* 115; of the third, *limb* 0,

micrometer 130; and of the fourth, *limb* 0, *micrometer* 145[1]. As soon as the sheaf is formed, an aiming point is selected, and the deflection for each gun measured and recorded. In the other two batteries, the sheaf is formed by laying on the sight of the directing gun; deflections are measured and recorded as in the first battery. The pieces are not anchored.

Caissons are used for observation stations. Those of the major and the commander of the right battery are placed on the main road near the guns. That of the captain of the left battery would have to be some 300 meters to the left front, for the pieces here have about six meters defilade against the Bournalières crest; the captain can get only three meters from the ground by standing on the caisson, and so has to get the other three meters by going to the front. To assure his communication with the guns, he should post two or three men to transmit orders. The only place for the captain of the center battery is near the left piece of the right battery; orders should be transmitted as in the case of the left battery.

Suppose now that flashes are seen in the hedge to the left and in front of the white house, and that projectiles burst on the front slope of the crest masking the battalion. The captain of the third battery, without waiting for orders, prepares to return the fire. Estimating that the flashes are about 10 mils to the left of the reference point, and that they cover a front of 50 mils, he commands: "Add 10; anchor." He then gives his commands for firing upon the hostile battery, which we will call B′. The latter soon ceases firing, and thereafter whenever it recommences it is again silenced by R‴, which is completely concealed and can not be injured by the enemy's fire.

The enemy now opens with another battery, B″, whose flashes are from 20 to 50 mils to the left of the small round tree. The major directs the second battery to return its fire. The tree being 100 mils to the right of the house, the captain commands: "Subtract 80; anchor," and opens fire. The flashes of this battery are, of course, visible to the enemy. The director announces that it is under fire, and that the flashes of a new battery, B′″, are seen from 10 to 40 mils to the right of the round tree. The captain of R′ commands: "Subtract 140; anchor," and opens fire. The battery

[1] Corresponding to "Deflection 0, increase by 15," with the American matériel.—*Translator*.

simulates fire for a few minutes, the director calling the shots; the session is then terminated.

SECOND SESSION.

The battalion is organized as in the first session,—one battery only taking out its guns. The assembly is on the Quinxay road, near Pouzioux cemetery, about 1,000 meters beyond the Bournalières crest.

The director announces that the general situation is the same as before, but that the operations of the artillery battalion marching with the Blue advance guard will be the subject for the day's conference.

When the battalion commander receives orders to come into action, the Bournalières crest cuts off the view in the direction of the enemy. Rifle fire is heard in front, where the leading infantry battalion is already engaged. A few minutes after the battalion commander starts on reconnaissance, artillery fire is heard, and projectiles burst on the Bournalières crest near the target range.

The party moves to the Bournalières crest, following the route of the battalion commander's reconnaissance party. On the way, the director points out the position where the batteries are to halt and wait orders. To avoid damage to crops, the guns are held on the Pouzioux—Bournalières road, near the place indicated.

Arriving on the crest, between the target range and the large white house, the director states the situation as follows:

"The enemy's artillery has been seen in the distance, marching on the main road. Later, it opened fire upon our infantry crossing the crest, but nothing has been seen of it, not even the flashes. The advance guard commander orders his artillery battalion into position in observation on this crest, to support the advance of the infantry.

"As in the last exercise, we will pass rapidly over matters of maneuver, with which all are familiar, and devote most of our time to firing. Before reconnoitering positions for the batteries, we will study for a moment the view before us (Fig. K″).

"The military crest of the hill is 500 or 600 meters in front of us. Beyond are woods (*i*), the hamlets of L'Arnaye (*k*) and La Cadoue (*l*), and between the two hamlets part of the Poitiers—Quinxay road (*ab*). Between the military crest and these points the ground

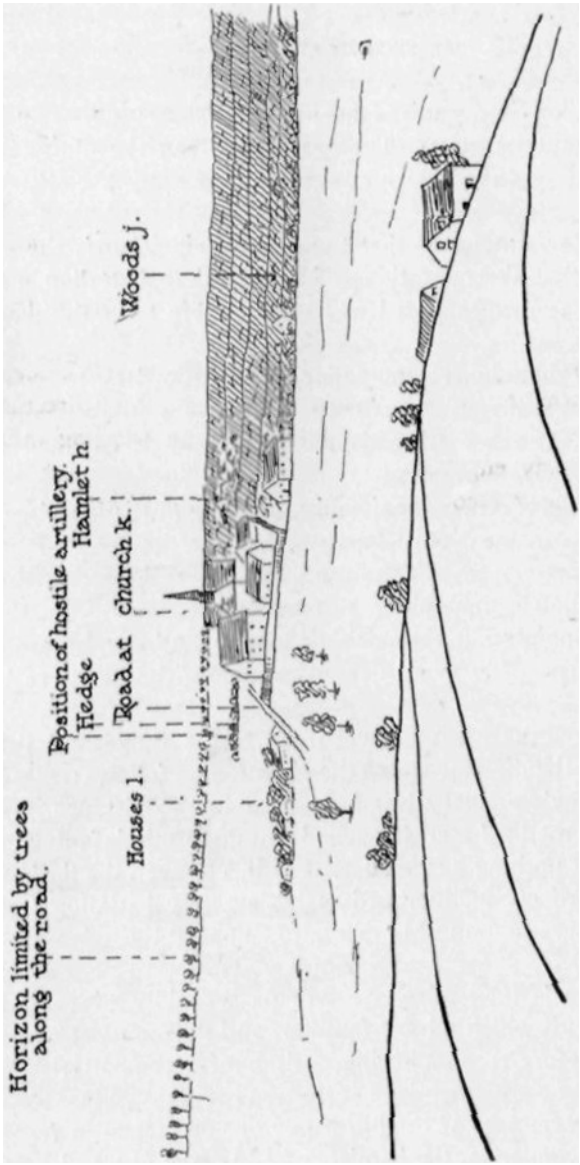

Horizon limited by trees along the road.
Houses l.
Road at
church k.
Hedge
Position of hostile artillery.
Hamlet h.
Woods j.

Fig.K."

seems to be slightly rolling, for the tops of trees and the roofs of houses can be seen in places.

"The woods and L'Arnaye cut off the view of anything beyond, but the battalion commander knows that the Blue infantry is there and in La Cadoue. Just to the right of L'Arnaye are the roofs of La Blaiserie; hostile skirmishers can be made out there, and behind a hedge a little below the sky line and to the left of the church tower. It appears probable that the enemy's artillery position is masked by the crest beyond this hedge. The form of the ground behind this crest is indicated pretty clearly by the trees along the road; at the extreme left the entire trees are visible, while at the right, in the direction of the church tower, only their tops project above the crest."

After thus analyzing the panorama before him, the battalion commander proceeds to reconnoiter his position. The director makes this reconnaissance accompanied by all the officers, and sums up his conclusions as follows:

"The Bournalières crest (Fig. L″) is partly covered by houses, vineyards, orchards and gardens, enclosed by walls or hedges. It falls off rapidly from the target range toward the Quinxay road, and hence, although its length is considerable, there are only two artillery positions.

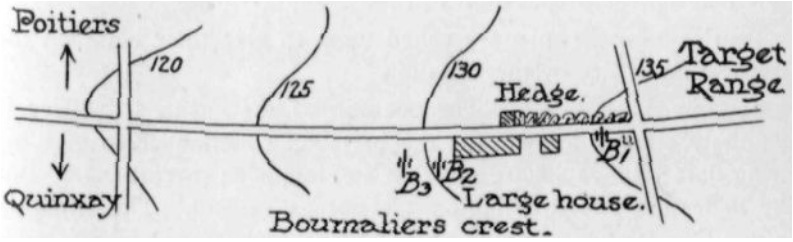


Fig.L."

"The first is on the road, between the target range and the large house. There is a high hedge which will conceal the guns, but not the flashes. A slight slope at the foot of the hedge will stop bullets close to the ground. The guns can be placed near enough the house to permit the captain to take his position at one of the windows, where his view will be excellent. There is room for only one battery.

"The other position, large enough for the other two batteries, is 300 or 400 meters the other side of the house, where there is a gap of 150 or 200 meters between the houses and the clumps of trees along the road. This peculiarity leads the battalion commander to seek either dismounted defilade or else a very high defilade, say six meters; for if anything between these two were taken the projectiles would be likely to strike the trees or houses, unless the breadth of the field of fire were unduly limited. With dismounted defilade the guns will be so close to the gap that they can fire through it, and with the high defilade the projectiles will pass over.

"The battalion commander decides to place one battery, B′, on the road, behind the hedge, near the large house; the other two, B″ and B‴, in rear of the road, just concealed from the crest to the right of the church tower. The gunners will be brought to the position ahead of the battery, so that preparation of fire may be completed as nearly as possible; and the batteries will come into position at a trot, drivers mounted. It is hoped that the occupation of position will not be observed; for the hedge screens one battery, and the sun is directly behind the others.

"The problem is now fully stated. The orders of the battalion are to support the infantry advance; we are familiar with the ground, and we know where the hostile and friendly troops are. We will now take up the preparation of fire."

Two captains in turn are called upon to give their ideas on the preparation of fire by the battalion.

Captain A answers: "The position of the enemy's artillery is definitely enough known for the battalion commander to give, as firing data: Range 2,600; angle of site, minus 5; corrector 18. But the deflection and distribution are not as evident. The situation is one that is very common on varied ground; there are reference or aiming points enough in the general vicinity of the target, but none on the crest itself. In front of the crest we have the orchard and hedge, and behind it the trees along the road; all these are clear distinct points, but the exact position of the target with reference to them is unknown. I say unknown, for it is hardly justifiable to make use of the large scale map, which we would not be likely to have in service. And besides, a reference point is not satisfactory unless it can be used without making any convergence calculations.

"The object of our present work is to reduce to a minimum the number of things to be done after the target appears, in order to save time in opening fire, and reduce the risk of mistaking the target. If now nothing is done to fix deflections, let us see what will have to be done when the target appears.

"The captain will point out the target to his lieutenants, and each of them will prepare to sweep half of it. To this end, he will point his pieces approximately, and each gunner will then pick out his own aiming point and measure his deflection. It seems to me, then, that little need be done in the way of preparation for laying in direction; it will be enough to agree upon the nomenclature of the most conspicuous landmarks, so that targets can be designated quickly and accurately."

Captain B's solution is different; when called upon for his views, he says:

"I think we can save the time required for designating the target, laying the guns, and measuring the deflection. We can do as we did in the last exercise, although the degree of defilade is not now the same; we can form the sheaf beforehand, so as to turn our fire upon any target by a mere change in deflection.

"I would suggest laying the directing gun in the probable direction of the target, and then reading and recording the deflection to the church tower, which is a conspicuous and unmistakable aiming point. I would next lay the other guns parallel to the first, and read their deflections. With the normal interval of 15 meters between guns, and a range of 2,500 meters, the deflection difference for parallel fire will be about 5; I would increase by 10 from right to left, making a total distribution difference of 15, and relay all but the directing gun.

"If gun flashes are seen, and a battery directed to open fire, the captain will place himself near his directing gun and measure the angle from the axis of the gun to the right extremity of the front covered by the flashes. Suppose this angle is 30 mils to the right; he will command: "Subtract 30; anchor," and open fire.

"The battalion commander's orders, in full, would be about in this form:

"'Range, 2,600; angle of site, minus 5; corrector, 18. The sector of observation is from about 200 mils to the left of the church tower to about 40 mils to the right of it; each battery will direct its sheaf upon the center of the sector, with 15 mils distribution

difference. The first battery will open fire upon any hostile artillery that it may discover, without waiting for further orders. The captains of the other two batteries will report to me when ready; I shall be between the two batteries.'"

Comments of the director. "I will first state my objections to the two proposed solutions, and then give my own.

"Captain A proposes to use individual laying. In this case, there are a number of objections to this, the principal ones being that it takes longer to designate a target than to say 'add 50,' and that the distribution is likely to be faulty because too many individuals have a hand in making it.

"Captain A says there is no good reference point. I should say, on the contrary, that there is an excellent one,—the tree where the road crosses the crest. This tree is on the crest itself, and, the crest being oblique, it is at about the same range as the enemy's artillery.

"Captain B's idea is to form the sheaf, and when a target appears measure the angle between its right and the axis of the directing gun. But this is hardly practicable when the pieces have more than sight defilade; and besides, it would necessitate the captain's leaving his observing station at the window and going down to the guns.

"Both officers seem to have lost sight of the orders of the battalion, which are to support the advance of the infantry. To do this, it must be ready to fire upon the enemy's infantry as well as his artillery. Different batteries must be assigned to fire upon the different targets; and since the captain of B′ has an observing station high up in the window of the house, he can best engage the enemy's concealed batteries. My plan would be for the battalion commander to give the following orders:

"'Firing data for the crest to the left of the church tower:—angle of site, minus 5; range, 2,600; reference point, directly over this bush, a tree beside the road, pointed at the top and higher than the others. Battery B′″ will prepare to fire upon the enemy's infantry whenever an opportunity arises; B′ will fire upon his artillery as soon as it can be located; B″ will hold itself in readiness to assist either of the other batteries when called upon. I shall be in the large house.'"

"We will adopt this solution, and follow the course of action of battery B′, which is now waiting on the road from Pouzioux to

Bournalières. Captain, you know your orders; put your battery in position in observation on the road near the house."

The captain brings his battery into position, directs his right gun upon the tree selected as reference point, and takes his station at a second story window of the large house. The director then gives him information as to the assumed progress of the action and the effect of fire.

Director.	*Battery Commander.*
Shrapnel fire is opened upon B″ and B‴. There is nothing to show the position of the hostile artillery.	
	No orders.
B″ and B‴ open fire upon the enemy's infantry; the enemy's artillery again fires upon them. Flashes are seen just above the crest, two finger-breadths to the left of the church tower.	
	Subtract 140; anchor; by battery from the right; corrector 18; range 2600.
Direction good, average height of burst 2 mils, range doubtful. The enemy's artillery fire continues.	
	Corrector 17; range 2600.
Average height 1 mil, short.	
	Range 3000.
Over the crest, in front of the trees along the road. The enemy's fire continues.	
	Range 2800.
Shrapnel fire is opened upon B′; the men lie down at the foot of the hedge. The chief of the second section, his gunner and one cannoneer are wounded.	
	Causes the men designated to fall out.
The enemy's artillery fire ceases.	
	Nos. 2, 3 and 4 cease firing. No. 1, percussion shrapnel, range 2700.
Short.	
	Range 2900.
Over, behind the crest.	
	Range 3100.
Lost.	
	Volley fire two rounds; corrector 19; range 3100.
Behind the crest and in front of the trees.	
	Volley fire two rounds; corrector 19; range 3300.
Behind the trees. The enemy's artillery again fires upon the battery, and the chief of the first platoon is wounded; the men take cover. After a time the fire ceases.	
	No. 1, percussion shrapnel, range 3100.
Lost.	
	Range 3000.
Over; smoke just shows above crest.	
	Range 3000.

Same observation.	Range 2800.
Over.	Range 2800.
Over.	Range 2700.
On the crest.	Range 2700.
On the crest.	In observation; corrector 19.
B″ and B‴ open fire upon the enemy's infantry; shrapnel fire opens upon them, and flashes are seen on the sky line.	Volley fire two rounds, range 3000.
Shrapnel fire upon B′; the men take cover.	
Cease firing; rest.	

Before terminating this exercise, the director explains its object and the method of conducting it, as follows:

"My intention was to make the situation as realistic as possible for all the personnel of the battery, and especially to require the captain to conduct his fire as he would do in service. To this end, I assumed the following course of events:

"B‴ fires upon the enemy's infantry. A few minutes afterwards, shrapnel fire is opened upon it; neither the battalion commander nor the captain of B′ can determine the position of the hostile guns. B‴ makes several attempts to fire upon the infantry, but is always neutralized at once. B″ opens fire upon the infantry, and instantly receives shrapnel fire. The flashes of R′, which is doing this firing, are seen by the captain of B′, who returns the fire. The flashes of B′ are seen by another hostile battery, R″, which opens upon it. From this time on B′ is constantly neutralized by R″, suffers some losses in men, and can fire only intermittently.

"My decisions on the fire of B′ were based on a study of the ground about the position of R″, which had led me to adopt minus 5 as the angle of site of the crest; 19 as the corrector setting for a burst three mils above it; 2,700 as the range to the crest; 3,000 as the range to the line of flash defilade (where the smoke from a percussion burst ceases to be visible); and 3,200 as the range to the line of trees along the road."

THIRD SESSION.

The major orders out one firing battery complete, and all the available officers and noncommissioned officers of the battalion. The

party being assembled on the ridge east of La Blaiserie (Fig. I″), the director says:

"The general situation is still the same as in the two exercises just finished. Today we will study the operations of a battery placed under the orders of the colonel of a regiment of infantry, to sup port his attack upon the woods (*j*) and the hamlet of L'Arnaye (*k*. Fig. M″).

"We will assume that the battery commander, with his reconnaissance party, joins me here, where I will give him the instructions that he would receive from the infantry colonel.

"Looking west from where we stand, we see, 100 meters away, a lane. Farther on, at 300 meters, is a road (*n*) bordered by a high hedge, beyond which the ground slopes down gradually. About 500 meters farther on is La Blaiserie (*h*), and near it a clump of trees (*g*), at the extremity of the ridge behind which the Red artillery battalion is in position.

"The depression between the hedge and La Blaiserie will conceal an entire regiment. L'Arnaye, the church tower, and the adjacent woods (*j* and *k*) cut off the view at about 1,800 meters. The Bournalières crest is entirely masked, but an observer who is familiar with the country can just distinguish above the trees the red roof of the large white house which we used as a reference point in the first exercise.

"The instructions of the colonel to the battery commander are:

"'The regiment is assembling in this depression, and is about to attack the woods yonder, and that little village with the church. Halt your battery behind this ridge, and come with me on reconnaissance.'"

Accompanied by the whole party, the director now proceeds to reconnoiter the position, thinking aloud as he goes along, to let the battery commander see his intentions. Before leaving the assembly point he says:

"Here is a position, behind the hedge (Fig. M″), from which the battery could fire upon the woods and walls. The range and the view are satisfactory, and the battery would be concealed from hostile artillery on the other side of the woods."

The party then moves to La Blaiserie, where the director continues:

"Here is another good battery position, on the left of La Blaiserie.

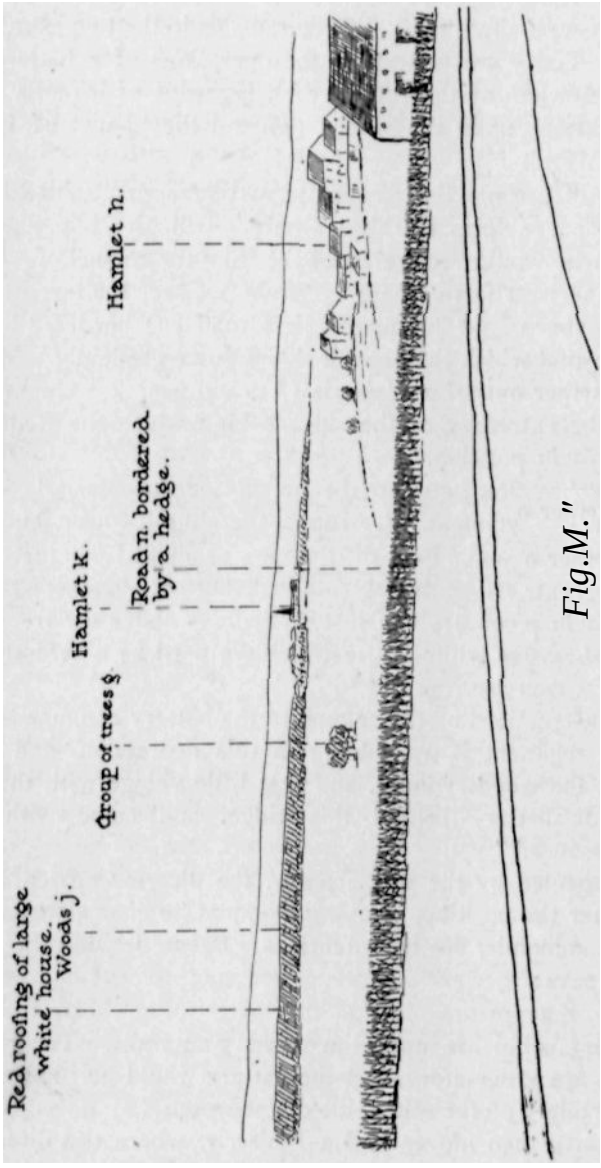

Red roofing of large white house.
Woods j.
Group of trees §
Hamlet K.
Road n. bordered by a hedge.
Hamlet n.

Fig.M."

"Shall I attack the woods or the village? The woods seem pretty hard to get at, for the ground in front is open, and the enemy can deploy on a broad front. The village should be easier; there is some cover in front of it,—road ditches and slightly undulating ground,—and the enemy is restricted to a narrow front. The artillery can set fire to the houses, break down the walls, keep the defenders down, and hide our attack behind a curtain of smoke.

"There are two possible battery positions; both give concealment from the Bournalières crest, and good view of the enemy's position. From the first the range is about 1,800 meters, from the second only 1,200. The second seems to be the better; the battery commander can see the movements of the infantry better, and so direct his fire more easily; and, being nearer to the infantry, the moral effect will be better.

"All this ground (*ghkj*, Fig. I″) being screened from view from the Bournalières position, it may well be that the enemy has some guns placed so as to cover it by oblique fire. But even if he has, the battery should be able to hold its own, for its position will be covered.

"Occupy this second position, and prepare to support the attack."

It is always well for the officer who is to conduct such an exercise as this to have clearly in mind the enemy's dispositions. In this case, the director has assumed that the edge of the woods and the wall of L'Arnaye are prepared for defense, and that there are two guns to the right and in rear of La Cadoue (*l*). While planning the exercise, he has made a detailed examination of the hostile position, and has made up his mind how it would probably be occupied. In regard to the artillery, he has noted that the guns can not be brought through the woods to take position in the edge, and that they would be too much exposed if placed in front of L'Arnaye; and that therefore the only suitable position for them is near La Cadoue, where they get an oblique fire upon the ground over which an attack must pass.

The captain now sends for his battery and reconnoiters his position. Leaving the guns limbered, behind the crest, he brings his chiefs of platoon and gunners up to the position, and posts himself where he can observe the action. The director remains with him, and from time to time tells him what is assumed to be going on. He gives no orders, but leaves the captain to act on the information he receives, as would usually be the case in service.

The battery commander has learned, during the reconnaissance, what is required of him. He knows that he is to support the attack upon L'Arnaye; and in doing this he sees that he will have to fire upon several different targets. First, he must break down the wall in front of the place; secondly, set fire to the buildings and stop the fire from the upper windows; thirdly, keep down the fire from that part of the position against which the attack is directed; and finally, neutralize any hostile artillery that may seek to interfere.

The captain being ready, the director states a situation, which requires the battery to take position. He then states another which requires it to open fire. Then follows a series of such situations, picturing the whole course of an infantry attack. The director has studied out his firing problems beforehand, and the simulated fire called for makes an excellent preparation for service target practice. Not having to devote any attention to actual observation of fire, the officers concerned can concentrate their minds upon the details of its execution.

To be in a position to reply to any artillery fire that may develop, the battery commander takes a considerable interval between his two platoons. If this were not done, then when the enemy's artillery fire began to reach the battery it would find it impossible to reply effectively. This is a good general rule: when a battery is accompanying an infantry column, and no counterbattery has been assigned, it should make its dispositions so as to be its own counterbattery. Here, then, the interval between the platoons is made 50 meters.

1. The first thing to be done is to breach the wall, for this fire must be accurately adjusted, and there might be no opportunity for it after the action had begun. The battery commander will as a rule be left to decide for himself where to make the breach and when to open fire; in this case he selects that part of the wall nearest the Quinxay road, since the infantry can get closer up without undue exposure than anywhere else. Only the first platoon fires, the second remaining in observation. The captain announces an aiming point and an angle of site, and has the pieces anchored; the adjustment and fire for effect offer no difficulty.

2. The breach being made, the captain casts loose his guns and prepares to fire upon the two buildings to the right and left of the

church tower. From center to center of these two buildings measures 50 mils. The range to the wall having been found to be 1,225 meters, that to the buildings is estimated at 1,275. The captain commands:

"Aiming point, the church tower; deflection,—No. 1, limb, 0 micrometer 75,—No. 2, limb 0 micrometer 125; anchor; percussion shrapnel; with the collimator; lay on the lower edge of the roof."

Here the director interrupts to fall out two cannoneers of the first section, as hit by infantry fire. The captain continues:

"Volley fire two rounds; range 1,250."

The director calls "short"; the captain commands:

"Volley fire two rounds; range 1,300."

And so the adjustment is continued. The "shorts" strike the front of the buildings, and the "overs" the roofs. Having gotten a 25-meter bracket, the captain sweeps by three turns of the traversing wheels, so as to get hits in all parts of the upper stories.

3. While this fire is in progress, the director has several bombs, representing the burst of hostile projectiles, exploded in front of the first platoon; the men take cover. Flashes, represented by fireworks, are seen among the trees and bushes to the right of La Cadoue. The director has assumed that the enemy has two guns, placed between two hedges, and that the ranges are,—to the first hedge, 1,550 meters; to the second, 1,800; and to the guns, 1,600. He also assumes that "corrector 16" will give a three mil burst.

As soon as he sees the flashes, the chief of the second platoon commands: "By battery from the right; corrector 18; range 1,600." The director announces the observation: "Direction good; mean height 5 mils; range doubtful."

The next command is: "Corrector 14; range 1,600." The projectiles fall among the bushes near where the flashes were seen. "Corrector 15, range 1,400" gives a "short"; so also does "Corrector 15, range 1,500." The next commands are: "Corrector 16; zone fire; range 1,500"; followed by "Corrector 14; range 1,800." The last shots are in the farther hedge, and hence certainly over the target.

The enemy's artillery ceases firing, and the first platoon opens again. One of the houses in L'Arnaye takes fire; the first platoon continues a slow fire, sweeping, to increase the damage and to keep down the enemy's rifle fire from the windows.

The chief of the second platoon now tries to determine the form of the ground at the enemy's artillery position. To this end he commands: "No. 4 cease firing; No. 3 percussion shrapnel; range 1,500." The shot being short, he tries 1,600 and 1,700; the smoke of the bursts is among the bushes. Range 1,800 gives an "over" with respect to the farther hedge; the range being tried again, the burst is in the hedge. The chief of platoon concludes that, to be sure of reaching the target, he must use ranges 1,500, 1,600 and 1,700.

4. The infantry now advances to the attack, reinforcing the skirmish line as it pushes forward. The first platoon seeks to keep down the rifle fire from the vicinity of the breach in the wall, while the second neutralizes the hostile artillery, which succeeds in firing only intermittently.

The guns of the first platoon are laid with a distribution difference of 50 mils, one on each side of the breach, and anchored. The range being 1,225 meters, they sweep by ten turns of the wheel, or 20 mils, and utilize the full traverse on the axle. The projectiles are thus distributed about 25 meters apart over a front of from 150 to 250 meters. The chief of platoon regulates his rate of fire according to the situation as stated by the director. When the infantry is within a few hundred meters of the enemy, he passes to percussion fire, increases his range, takes up time fire again, increases the range still more, and finally ceases firing but remains in observation, ready to move forward at any moment.

The chief of the second platoon keeps up a continuous fire with the ranges 1,500, 1,600 and 1,700, one gun firing at 1,500 when the other is firing at 1,700.

The simulated fire being ended, the director dismisses the battery, and takes the officers and special details over to the hostile position to verify his solutions for the various firing problems. He points out the position assumed for the hostile artillery, which is at the head of a long draw; such a position is very suitable for an infantry battery, which has to be prepared to fire upon targets in the low ground. It is often hard to find a position which is not too close to the infantry line, and which is not on the front slope; but if there is a long draw, both difficulties may be avoided by getting behind the crest at the head of it.

He also calls attention to the three separate ridges behind L'Arnaye and the woods (Fig. N″), and shows how, in pushing on

toward the Bournalières crest, where the enemy's artillery line is, the same problems would have to be solved over and over again, on varied ground.

The exercise shows the necessity for all artillery officers to understand clearly the action of infantry. If it is not possible always to maneuver with infantry, at least every opportunity should be seized to have infantry officers present, to outline the progress of the infantry combat. Good use may thus be made of infantry officers serving by detail in the artillery; it is a good plan to have them act, where possible, as directors of the exercises.

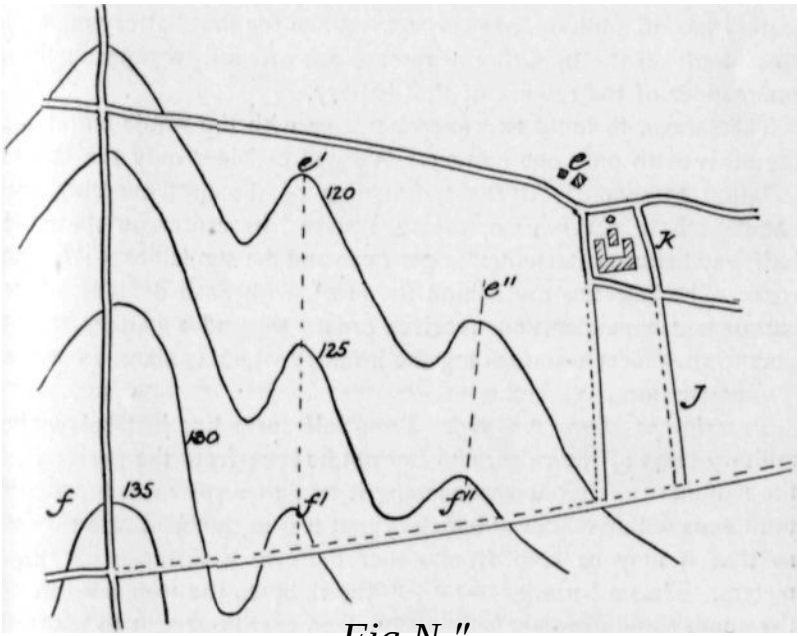


Fig.N."

ADDITIONAL EXERCISES WITH MATÉRIEL.

FIRST SESSION.

Operations of an Infantry Battery.

The assembly is announced for 10 o'clock noon, at the Porte du Cerf-Volant, on the road from Versailles to Toussus-le-Noble. The battalion commander acts as director; with him is an infantry officer serving by detail in the regiment,

whose duty it is to outline the infantry action, and a lieutenant as assistant. A captain acts as battalion commander, with one staff officer and five agents and scouts. Only the first battery takes out any matériel; it has its four guns and six caissons, one of which is with the reserve. Each of the other two batteries is represented by one officer in command, assisted by a corporal and a trumpeter; two chiefs of platoon; and two privates, carrying flags, to mark the head and tail, or right and left. The battalion reserve is commanded by a lieutenant, who has four men as agents and scouts; the reserve of each battery is represented by a non-commissioned officer, with two privates carrying flags, and the first battery has, in addition, one caisson. When the first battery maneuvers alone, all the men of the reserve are ordered to report to the commander of the reserve of that battery.

The session includes two exercises, one with the whole battalion, the other with only one battery. We will consider only the latter.

Initial Situation. At the termination of the first exercise, the battalion is in observation, facing Toussus, its center on the road half way between Porte-des-Loges farm and the Versailles—Toussus road. The batteries are behind the crest, with flash defilade. The battalion commander now receives orders to send a battery to report to the officer commanding the infantry which is about to attack Trou-Salé farm.

Description of the Ground. Trou-Salé farm lies just below the military crest of the ridge, and can not be seen from the position of the battalion. A scout approaching it by either road can not see it until he is within 300 or 400 meters; but it is at the bend of a ravine, so that it may be seen from either flank at a distance of 1,000 meters. Thus a battery sent out to the right, to the woods north of the pond, could fire upon it easily; and so could one sent to the left to the edge of the woods covering the slope of the ravine. The farm buildings are strong, and are enclosed by a heavy wall, so that the infantry assigned to attack it absolutely needs artillery to breach the wall, set fire to the buildings and drive out their defenders, and keep down rifle fire from the whole farm.

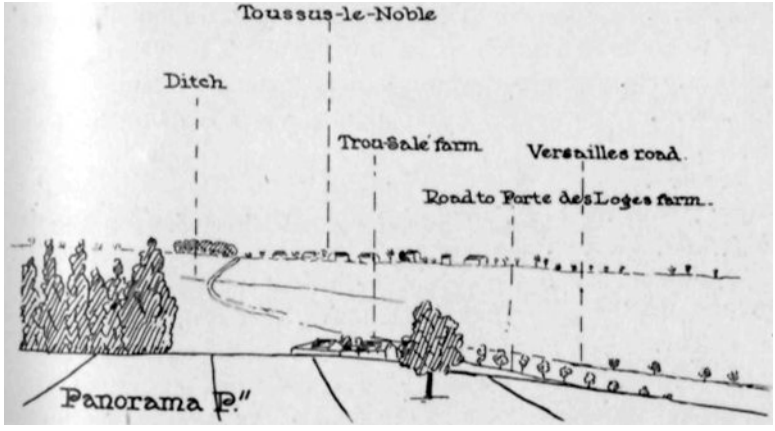
Reconnaissance. The first battery is designated to accompany the infantry; the officers and men of the others join the director. The battery commander reports to the infantry officer assisting the director, who is designated to command the attack, and the two

together make their reconnaissance. The infantry commander points out the positions of the hostile infantry and artillery, and stares the situation as follows:

"The enemy's infantry occupies Trou- Salé farm, and the overflow ditch of the pond. There is artillery behind the crest, to the left (east) of Toussus. Our infantry is out in front; its right is in the woods north of the pond, and its left in those on the slope of the ravine; its center is on the military crest, 500 or 600 meters from the farm wall. The attack is to be made by that part of the infantry which is nearest the enemy, and at the same time not too much exposed, which means that part which is opposite the north face of the farm.

"To support this attack, the battery should be on the slope of the ravine, in the edge of the woods. It can reach its position under cover; the range will be about 1,000 meters."

(Fig. P″ shows the panorama seen by the battery commander when he reaches the position selected.)



"The battery will first make a breach in the wall, and then set fire to the houses. The flames will be the signal for the attack. When the infantry moves forward, the battery will keep down the fire of the defenders."

Action of the Battery. As soon as the position is indicated to the battery commander, he sends orders to his senior lieutenant to bring up the battery, keeping it out of sight. The captain selects a place for the guns which he thinks they can reach under the cover of two

or three clumps of trees; the battery comes into position at a trot, the limbers are posted behind a hedge at the head of the ravine, 100 meters to the left rear, and the reserve remains in a fold of the ground 400 meters away. Simulated fire is then taken up.

1. *Percussion fire upon the wall*. The director from time to time has men fall out, as hit by rifle fire,—the captain, two chiefs of section, one gunner and two cannoneers. The senior lieutenant takes command, and continues the fire, acting on his own initiative. The infantry officer gives him such information as he could get in service from his own observation, as follows:

"You have made a breach in the wall. Our artillery, on the other side of Porte-des-Loges farm, is firing upon the enemy's artillery."

The battery ceases firing; the lieutenant says that he will remain in observation until the attack commences.

2. *Time fire upon troops behind the wall*. The infantry officer says: "You see a compact body of our infantry make a rush toward the farm."

The battery opens continuous fire, one shot per gun per minute.

"The infantry halts and lies down. Another body rushes for ward."

3. *Time fire* as before, two shots per gun per minute.

"The infantry has now come within 200 meters of the breach."

4. *Percussion shrapnel*, four shots per gun per minute.

"Our infantry continues to advance."

5. *Percussion shrapnel* as before, but directed upon the farm buildings instead of the wall.

"You see the infantry begin to fall back, having failed to reach the wall. The enemy's artillery begins to fire upon the battery causing some loss."

6. *Time fire upon the wall*, four shots per gun per minute.

The director puts the second lieutenant and three cannoneers out of action. The battery is ordered to fall back to the main Versailles road. The limbers can not be brought up without being see by the enemy's artillery, and the situation becomes critical. The lieutenant decides to abandon his caissons, and to run the pieces back by hand to the limbers. The director puts five drivers and three teams out of action. The lieutenant finally gets what is left of the battery back to Porte-des-Loges farm, where it is reorganized, and losses in men and materiel replaced from the reserve.

Critique. The director approves the general handling of the battery, but points out several errors in the conduct of fire. After the breach in the wall had been made, he remarks, a few shots should have been fired for registration, the farm buildings should have been set on fire, and then slow continuous fire opened to keep down fire from along the wall.

SECOND SESSION.

Maneuver and Preparation of Fire, by Two Battalions of Divisional Artillery.

The assembly is at noon, at the Porte du Cerf-Volant on the road from Versailles to Toussus-le-Noble. The major acts as director, and is assisted by a lieutenant. A captain is designated to act as battalion commander; he is given one staff officer and five agents and scouts.

The first battery takes out its four guns and six caissons. Each of the other two is represented by one officer commanding, two scouts, two chiefs of platoon, four chiefs of section, four privates to carry the sights and hold horses, and one additional horseholder for each platoon.

The battalion reserves are represented by a lieutenant commanding, three agents and scouts, and three men with flags, each representing the leading carriage of a battery reserve.

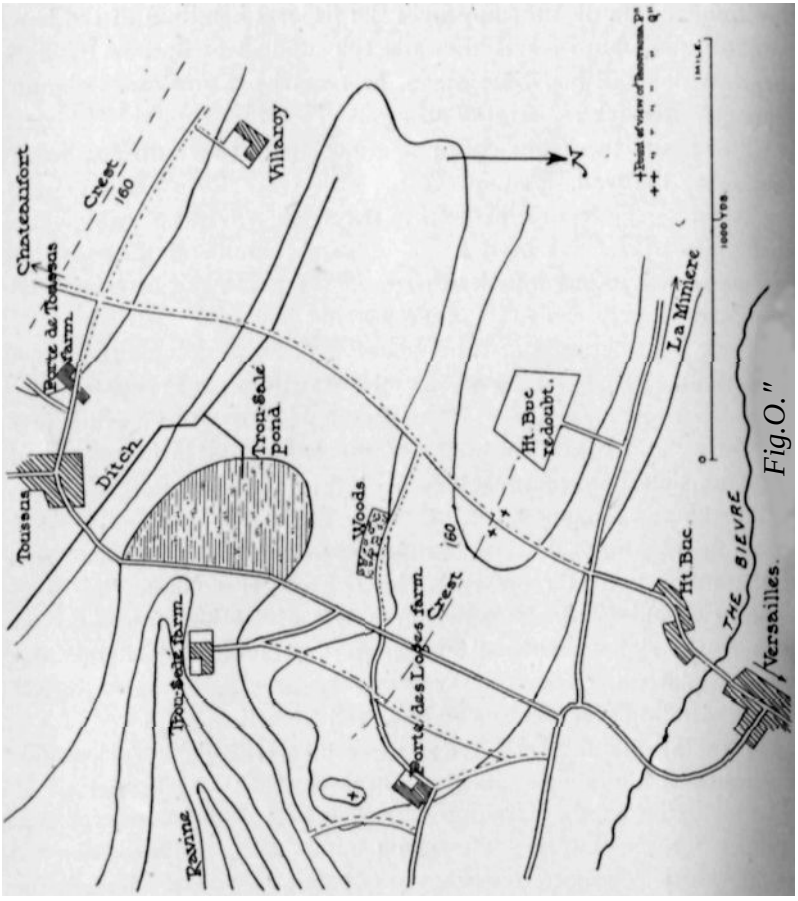
Part 1.

General Situation. Given out verbally by the director, at the assembly point, as follows:

"The three batteries represent the advance guard artillery battalion of an infantry division, marching by the road from Versailles to Chateaufort (Fig. O″). When the exercise begins, the head of the battalion is here, and the point of the advance guard 2,000 or 2,500 meters ahead, on the Haut-Buc plateau.

"The batteries will form in column with full distances, about 200 meters per battery. The order of march will be,—battalion commander and staff, first, second and third batteries, battalion reserve The column will move as if marching with infantry.

"As the head of the advance guard, having crossed the Bièvre, reaches the Haut-Buc plateau, it is attacked by hostile infantry and



forced to deploy. The advance guard commander sees that he will soon need his batteries, and sends for the battalion commander.

Assumptions. "To make the exercise more realistic, we will assume that the Haut-Buc redoubt does not exist, but that in its place there is a wood surrounded by a wall. We will also assume that the division is not marching alone, but that other divisions are on parallel roads to the right and left."

Operations. The column being formed, it moves out at a walk, as if following infantry. In about ten minutes the director's assistant brings orders for the battalion commander to come ahead on reconnaissance. The battalion commander turns over command to the senior captain, saying that he has been ordered to report to

the commander of the divisional artillery on the plateau beyond Haut-Buc; he then starts forward, directing his adjutant to mark the route. Reaching the plateau, he receives the following orders from the director:

"The first line of our infantry runs from the Haut-Buc woods (redoubt) to Porte-des-Loges farm (Fig. O″); the enemy's infantry occupies Trou-Salé farm and the ditch southwest of it. The enemy's artillery has been firing upon a column on the road 700 or 800 meters to our left, leading from Versailles to Toussus. His gun flashes were seen to the right rear of Toussus.

"Here is your position, behind the crest, to the left of the woods (redoubt). Place your battalion in observation, and prepare to fire upon the enemy's artillery; your sector of observation will be 600 or 700 mils, between those two farms,—Porte-de-Toussus on the left and Villaroy on the right."

The battalion commander at once sends back his adjutant to bring up the three battery commanders to reconnoiter their positions, and to have the battalion halted behind the crest.

Description of the Ground. The weather is clear, and the sun over the enemy's position. The ground is frozen, and lightly covered with snow. The country being mostly old hayfields, the carriages can easily move anywhere.

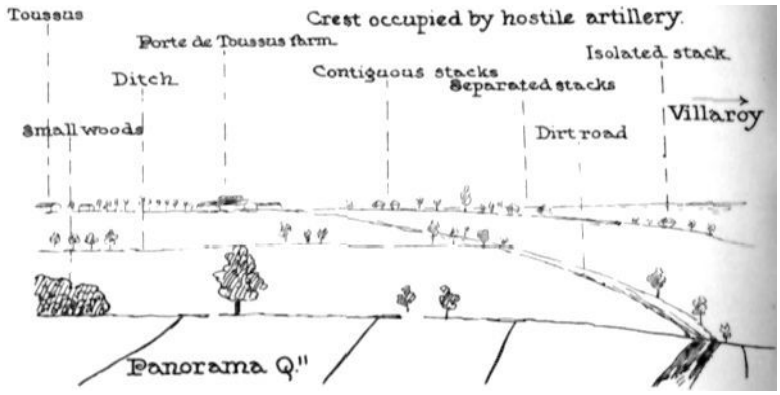
From the point where the road crosses the crest, the battalion commander has before his eyes the panorama shown in Fig. Q″. Just in front is the infantry skirmish line, along a road on the military crest. Beyond, the ground falls away to the Trou-Salé pond, which is almost concealed by a patch of woods. Still farther on the ground rises again in an even gentle slope; the road to Chateaufort is clearly seen ascending it. The sky line is formed by the houses of Toussus, a row of tall poplars, Porte-de-Toussus farm, the crest to be observed by the battalion, and the farm buildings of Villaroy. In front of the crest are a number of fruit trees and haystacks.

Selection of line of defilade. It being desirable to have the guns able to turn promptly from one target to another, the battalion commander at first thinks of taking only sight defilade, but decides upon dismounted defilade to avoid the danger of being discovered as he comes into action, since the observation conditions are very favorable to the enemy. The defilade is taken against the crest itself,

the trees, houses and haystacks being too far in front of it to be available as observation stations for the enemy.

Intervals. The position is large enough to permit an interval of 100 meters between batteries; they will thus be in less danger from shots intended for their neighbors, and the observation will be better. It is noted that the right battery can not see Villaroy, on account of the redoubt, so that the first and third batteries will have to cross fire.

Method of occupying position. The defilade is not sufficient to permit coming into position at a trot, but haste is not necessary. The position of each gun will be marked by the gunner, and the batteries will come up parallel to the crest, in double section column, drivers dismounted.



Preparation of fire. The range is about 2,500 meters, angle of site zero. To facilitate laying in direction, the battalion commander points out to the captains a number of conspicuous points, designating them by name. He divides the field into four sectors,—(1) from Porte-de-Toussus farm to two haystacks close together; (2) from there to two haystacks some ten meters apart; (3) from there to a single haystack; (4) from there to Villaroy farm. The captains remain with the battalion commander; when a target is assigned to any one of them, he is to run to his battery, point it out to his chiefs of platoon, and then give an aiming point, deflection and deflection difference.

Orders of the Battalion Commander. "The battalion will take position here, between the road and the redoubt. It is to observe the crest in front, and neutralize any artillery that may be discovered

there. The sector of observation is from that farm on the left, Porte-de-Toussus, to that one on the right, Villaroy.

"The guns will be on the line of dismounted defilade against the opposite crest, first battery with its right close to the redoubt, third with its left close to the road, second half way between them. They will come up in double section column parallel to the crest, drivers dismounted; the gunners will be posted to mark the positions for the pieces.

"Just in front of the enemy's crest and parallel to it you see a road, with trees and haystacks along it. For convenience in designating targets I will divide the front into four sectors:—commencing at Porte-de-Toussus farm, the right of the first is at two haystacks close together, of the second at two haystacks about ten meters apart, of the third at a single haystack, and of the fourth at Villaroy farm. The initial firing data will be:—range 2,500, angle of site 0, corrector 18."

Firing. The battalion being in position, the director has a bomb exploded. At this signal, an officer stationed on the opposite crest begins setting off flashes; twelve are seen within three minutes, distributed over a front of 60 mils in the left part of the third sector. The director announces that the infantry skirmish line is under fire, and the battalion commander assigns this target to the first battery.

The captain of this battery goes to his directing gun, and designates an aiming point; by the time five or six flashes have been shown he has given "limb 0 micrometer 150" as the deflection for the directing gun, and opened percussion fire upon the crest with a distribution difference of 15. As other flashes appear, he corrects his deflection and distribution.

When the first battery opens fire, the director explodes another bomb. Flashes appear in the center of the second sector, and the director announces that the first battery is now under fire. The battalion commander assigns the new target to the second battery. The captain has had his guns trained upon a tree in the middle of the sector, with "limb 0 micrometer 100" for the deflection of his right gun, and a distribution difference of 15. He now notes the direction of the flashes, and commands: "Subtract 20; percussion shrapnel; range 2,500."

Next, the director orders the captain of the third battery to open fire upon a line of artillery assumed to be taking position in

the middle of the first zone, with a front of 80 mils. The captain indicates the target to his chiefs of platoon, announces the interval between the two haystacks close together as an aiming point, gives a deflection of "limb 0 micrometer 130" and a distribution difference of 20, and opens fire.

Critique. The captain acting as battalion commander assembles the whole party, and says:

"I am very well satisfied with the whole exercise,—march, occupation of position and preparation of fire. I have only one point to speak of.

"I intentionally gave no orders to the battalion reserve; I wanted to see if the agent of communication would ask for them. Agents marching with a battalion commander ought always to do this. The battalion commander has a great many things to think of when he is putting his batteries into position, and may forget about his reserve; but the agent has only one thing to do, and that is to get orders."

The enlisted men then join the batteries, and the battalion commander continues, addressing the officers alone:

"I have nothing to say about the march of approach, the reconnaissance, and the preparations for occupying the position. The actual occupation of position, too, was well done; but I have one remark for the senior lieutenants of the second and third batteries. When the captains started on reconnaissance, they should have come up to the head of the whole column; and when they saw their own battery commanders reconnoitering positions, they should have conducted the batteries as near to them as they could.

"The reserve was well placed, in rear of the redoubt.

"The preparation of fire was good, as far as it went, but I think it was incomplete. The different batteries did not follow the same plan, and the captain of the second did much more in the way of preparation than the others, so that he was able to open fire twice as quickly. I ought to have required his plan to be carried out in the other batteries; to this end, after giving the initial firing data,—"Range 2,500, angle of site 0, corrector 18," I should have continued:

"'Form the sheaf with a distribution difference of 15, and direct it upon the tall lone tree in the center of the second sector.'"

The director postpones his critique until the end of the session and directs the battalion commander to withdraw from his position

without attracting the attention of the enemy's artillery; then to reform his column, facing Toussus, head at the road to La Minière, and to bring all officers and non-commissioned officers up to hear the next situation.

The limbers are brought up as close as possible, drivers dismounted, in double section column parallel to the crest; the guns and caissons are run back by hand and limbered, the limbers on the side nearest the crest being pulled slightly ahead to facilitate the movement.

Part 2.

Situation. The party being assembled, the director says:

"The new situation is a continuation of the old one. The batteries now represent a second battalion; the first is assumed to remain where it was, as indicated by the two flags left in position.

"The second battalion was marching with the main body, about three kilometers behind the first. As it reaches the Bièvre, it is ordered up to reinforce the first. We will execute only the most interesting part of the maneuver; the following operations will be assumed to have been completed.

"Upon receipt of his orders, the battalion commander got his batteries clear of the infantry column, and brought them forward at a trot. As soon as they were well started, he turned over command to the senior battery commander, directing him to follow at eight kilometers per hour; guided by the agent, he then rode rapidly forward to join the artillery commander, marking the route as he went. The distance is only about two kilometers, and so we will assume that he can get to the position only seven or eight minutes ahead of the batteries.

"I will now go ahead to the position. When I reach there, the battalion commander may start forward on reconnaissance; the batteries will follow him in five minutes. I will give no further particulars now, but will from time to time furnish such information as would be obtained in an actual engagement."

Operations. The director returns to the position, and the battalion commander follows. Both move over to that part of the ridge on the left of the road. The battalion then moves forward, the senior captain keeping about 200 meters ahead. Receiving no

orders, he forms double section column, then line of double section columns at close intervals, captains at the heads of their batteries, and halts far enough behind the crest to be perfectly concealed.

Orders of the artillery commander. "The artillery duel seems to be going favorably to the first battalion; it appears to be able, at any moment, to neutralize the enemy's artillery behind the opposite crest, and also keep enough fire turned upon those two batteries that you can just make out between the farmhouses and those two haystacks to prevent them from moving. The enemy's infantry holds the ditch over there, and ours can make no progress.

"You will give our infantry both material and moral support; your right will be at the road, and you may extend your left as far as you like, and take large intervals between batteries. Fire upon the left hand one of those two batteries that are partly visible, and destroy its matériel as quickly as possible. At the same time be ready to assist the infantry as soon as it advances. The first battalion will continue its fire upon the other exposed battery.

"The firing data found by the battery next on your right are:—range 2,750, angle of site 0, corrector 19. To help you get into position, I have given orders for the first battalion to fire upon the hostile artillery."

Reconnaissance. The battalion commander looks over his ground, and decides to come into action rapidly, assign the first battery to fire upon the enemy's artillery, and hold the others to fire upon infantry. The first battery will open fire for effect as quickly as possible, and try to destroy its target; the others will for the present merely adjust upon the ditch. Having finished his reconnaissance, he takes position on the line of mounted defilade, in rear of the center of the position, and signals to his captains to join him.

Orders of the battalion commander. "The battalion will take position on this crest, first battery with its right on the road, the other two in regular order, with intervals equal to a battery front. All will come into position together, at a trot; I will mark the center.

"The target of the first battery will be the batteries whose guns are just visible between that farm, Porte-de-Toussus, and those two haystacks. It will fire upon only the left half; the first battalion will take the right half. Use shell; the firing data are:—range 2,700, angle of site 0. The other two batteries will fire upon infantry holding that ditch; each will take a front of at least 200 mils,

the second to the right of Toussus farm, the third to the left. Firing data:—range 1,800, angle of site minus 5, corrector 19.

"Put your batteries in position, at my signal."

The captains join their batteries, give their instructions, and then take post behind the battalion commander, each opposite the center of his position; the lieutenants form the batteries in line in rear of them. The captains then point out the targets to the chiefs of platoon and give their instructions for firing, after which each takes post in front of the center of his platoon. The whole battalion moves forward at a trot, at the signal of the battalion commander; as the officers reach the line of mounted defilade they hasten the pace a little, and halt at the battery positions, chiefs of platoon marking the line for the guns. The guns are unlimbered, and each battery simulates fire.

Critique. The director dismisses the batteries, assembles the officers, and criticises the solution of the problems as follows:

"I am very well satisfied with the execution of the exercise, everything having been done properly. But I should like to say a few words on the general conduct of fire.

"The battalion has acted throughout as if it were armed, not with 75 mm. guns, but with the old 90 mm. pieces, slightly improved.

"Think, first, how the first battalion took position. The guns were only slightly behind the crest, so that the gunners could see aiming points in front; the battery commanders remained with the battalion commander; and the interval between batteries was only 50 meters.

"My solution for this problem would have been to take flash defilade, and place the batteries in observation with a distribution difference of 15, guns directed upon a designated point, intervals between batteries at least 200 meters, each captain with his battery and the battalion commander on the left. The slope of the ground measures 1.5 on 100, so the guns would be 300 meters from the crest. To observe the fire, each captain would have a caisson a little in front of his guns.

"A little reflection will show how much better the battalion can do its work when so disposed. It should be able, without assistance, to neutralize the two batteries whose flashes were seen, and destroy the two that were exposed, thus leaving the second battalion available to fire upon infantry.

"The second battalion should then have taken dismounted defilade instead of coming upon the crest, with at least 200 meters interval between batteries. Two batteries should have opened fire upon the infantry, and the other awaited further orders."

(*To be continued*.)

SOME KENTUCKY STUD FARMS, AND THE REMOUNT POSSIBILITIES THEY SUGGEST.*

BY ROBERT M. DANFORD, 1ST LIEUTENANT, 5TH FIELD ARTILLERY,
SECRETARY, MOUNTED SERVICE SCHOOL.

As is well known, Germany, Switzerland, Austria, Italy, Russia, Holland, and Belgium, all spend generous sums on their government breeding bureaus. The expenditure of this money not only insures remounts for their armies, but it encourages an industry which materially contributes to their prosperity. We, who on account of our national prosperity, are most able to take the lead in such a work as this, are behind, and as a consequence suitable remounts for our army are now well nigh impossible to secure. France and Germany have the best remount systems. Their officers' chargers and service mounts are superior to those of any other countries, not even excepting England, the horse nursery of the world. In 1909 the national French expenditure on breeding bureaus was approximately $4,200,000. In 1908 the expenses of the government studs of Germany were $1,863,640. But that amount was reduced to less than one-half by receipts (sales, covering fees, and foal money), leaving a deficit of $840,640.

Germany has five "principal studs" and eighteen "rural studs." At the principal studs it is the chief duty to "*breed stallions for the rural studs* and horses for the Emperor's stables." In 1908 there were in the five principal studs 38 first-class thoroughbred stallions, 740 brood mares, and 2,460 colts and fillies. At the rural studs there were 3,438 stallions. The most important one of the principal studs is Trakenen, which dates from 1732 and covers an area of 10,855 acres. It is under the management of Baron von Oettingen who has recently written a most interesting and valuable book on "Horse Breeding in Theory and Practice." In 1909 there were 1700 horses at this stud. Of the 21 stallions, 13 were thoroughbreds, one an Anglo-Arab, and the rest half-breds reared at Trakenen, they having a distinct preponderance of pure thoroughbred blood. From Trakenen there are chosen annually for the rural studs 70 stallions. These

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* This article is an extract copy of report submitted September, 1911, after two months spent in Kentucky inspecting breeding farms.

animals must be without defects. If the commission which inspects them finds defective ones these are castrated, and in April and September of each year are sold for sums varying from $250 to $1000. The mares are inspected and defective ones sold in the same manner as the horses.

At the Imperial Graditz Stud attention is confined almost exclusively to the breeding of thoroughbreds that perform on the turf in the name of the stud. This is for the purpose of subjecting sires for the other government studs to the "race course test." Ard Patrick, the great English Derby winner of 1902, was purchased by the German government at a cost approximating $100,000. Another great Derby winner, Galtee More (1897), was purchased by the Russian government at the same figure, and subsequently by the German government at a cost of $70,000. Many other such purchases show that foreign governments do not hesitate to add the best blood to their studs regardless of cost. The United States could amply afford it and should do the same thing. Our system should be somewhat similar to that of the Germans; we should make a start with one "principal" or "national" stud.

It is but natural for horse lovers who have confined their attention and fancy to a particular breed to feel and insist that this breed most nearly meets the requirements of cavalry. However, any officer who has given the matter the most serious and unbiased study and consideration, feels not the slightest doubt but that the selected thoroughbred is the animal best qualified to sire the cavalry horse; that is, the cavalry horse should be a thoroughbred grade of one, but preferably two, three, or four top crosses. Uniformity in conformation, action, gait, endurance, or temperament, can never be attained without uniformity in breeding. It is a mistake to expect to breed uniform cavalry horses from sires of different breeds. The three and four top cross thoroughbred grades will be remarkably uniform, provided:—first, that all the thoroughbred sires have been bred alike and have been bred and selected to a type (which of course should be the cavalry type); second, that the foundation dams of these grades have been carefuly selected as possessing suitable conformation and temperament for cavalry purposes. These mares of necessity must be Standard Breds, Saddlers, Morgans, or "well bred" farmers' mares.

There are many reasons, both scientific and practical, why the grades should not be made the other way,—that is, for instance, by using a Morgan stallion on a thoroughbred mare. Although many officers prefer the grade, the pure thoroughbred of proper type, i. e., of good temper and proper conformation, and bred for constitutional vigor and staying power, with plenty of bone and substance, makes the ideal charger. Of this I am convinced through six years of observation and experience at the Mounted Service School. As a rule, officers who now graduate from the school where they have worked with thoroughbreds, saddlers, grades, and mongrels, entertain the same conviction and are not satisfied with anything short of the "blood" horse.

There has been considerable prejudice against the thoroughbred in the service. This has arisen through association with culls from the race track. No breed of horses in the world has suffered more in the hands of unprincipled sporting men (not sportsmen) than has the thoroughbred. In the hands of true lovers of the breed, however, he has not deteriorated and there are many thoroughbred families to-day that can show what the thoroughbred really is—the most perfect specimen of equine excellence in the world.

The only other breeds that could be considered as challenging the thoroughbred the place I have outlined for him above, are the Arabian, the Standard bred, the Saddler, the Morgan, and the two types (not breeds) Virginia and Irish Hunters.

The Arabian.—There are only a very few Arabians in America. The importation of the high caste Arab is attended with great expense and no little risk, for Arabs do not seem to breed well in England or in this country. Their fertiility is probably lower than that of any of our modern breeds. The Arabian is considered the purest breed known, and as he is the foundation of the thoroughbred, Arabian stallions are always admitted to registration in the English and American Stud Books. I have studied countless latter day thoroughbred pedigrees, but have never encountered an Arabian in them. This is a good indication, and I have been told by breeders, that for racing purposes at any rate it is breeding back to breed to an Arabian. He is too small for our purposes, averaging from 14 to 14.2 in height, and from 800 to 900 pounds in weight. He is unusually muscular in front, and this is one reason why he is an excellent weight carrier for his size. The Arabian is remarkable for endurance, for excellent legs and constitution, and for intelligence

and docility. On account of his intelligence he learns quickly and is easily trained, which means that he is always a genuine favorite wherever owned. His friends, I think, are overzealous in insisting that he should be our cavalry horse, and in citing incidents of his

BALLOT.

Chestnut Stallion, foaled 1904.

By Imported Voter—Cerito by Lowland Chief. Bred and owned by Mr. James R. Keene, Castleton Stud, Lexington, Ky. Winner of the Century, Suburban Handicap, Great Republic, Invincible Handicap Matron, Neptune, and other stakes and of $154,545.00 in stake moneys. Height 16.0½, weight 1170, girth 74 in., cannon 8 in. Great strength, substance and endurance. Raced until he was 6 years old. During his turf career was characterized as "Mr. Keene's sensational horse."

remarkable endurance to prove his claims. It can be stated as a general rule in nature that each species of plant or animal becomes native to that locality of the earth's surface where it finds food, climate and conditions best adapted to its needs. The Arabian is a native of a hot, dry, desert land. It is to be expected, therefore, that it can (and it does) in its native country or climate out-endure any other species of the horse. For this reason, it cannot be held remarkable that the British Army found the Arabian far superior

to other breeds in the campaign in Egypt, or that it longed for him in numbers in the arid Transvaal.

If we but knew where our next war were to be fought, that knowledge might profitably influence our method of breeding the necessary cavalry horses, but in the absence of such knowledge we should breed the horse that would be of the greatest service to us in our own temperate zone, where the climate and conditions are similar to those of the great countries that might chance to measure sabers (or speed) with us.

I believe that Arabian grades on small strongly built thoroughbred mares and quarter horse mares, especially if bred in a Southern California community, would make a horse of unsurpassed excellence for cavalry service in the Philippine Islands. Also, though perhaps not the best, this breeding would produce an excellent pony for polo.

The Standard Bred.—For over 60 years this horse has been bred to trot. The breed, springing from a number of sources, but with very strong infusions of thoroughbred blood, is distinctly an American product. Admission to registration was first based on performance, but as the type has become more and more fixed, restrictions as to registration have become more and more rigorous, until it is now practically impossible to register an animal unless trotting blood predominates in his veins. Messenger, a pure thoroughbred, is the foundation sire of this breed. The trotter is distinctly a light harness type, speed has been the great desideratum, and as a result much has been lost in point of conformation and good looks. A fast trotter is very frequently a most ungainly looking brute. It is only when he is extended in the race that his marvelous beauty of action becomes apparent and classes him as a truly great though not handsome animal. While an occasional individual of the breed would make an admirable cavalry horse, the average standard bred is, for that purpose, too heavy in front and has a back that is too long to carry weight. Furthermore, he dislikes to canter and when he does so he has a gait similar to that of a galloping steer, hard and pounding—his muscles and frame aren't made for it. His trot, being fast, is usually hard and uncomfortable to the rider. This lack of easy motion at the trot and gallop renders him particularly liable to saddle galls. On the other hand, the standard bred is an animal of great stamina and endurance. Thoroughbred

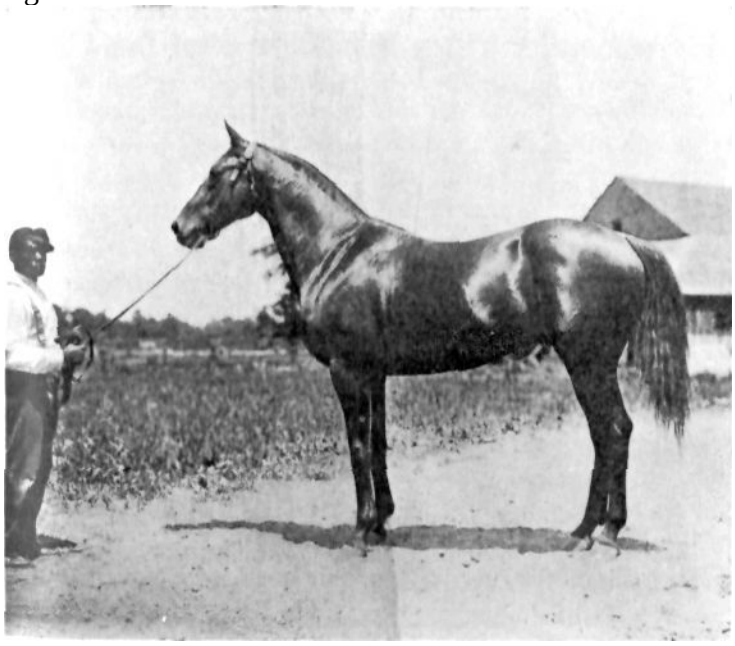
grades from mares of this breed, *carefully selected* as being of cavalry type, would unquestionably make excellent cavalry horses.

The Saddler.—This is another distinctly American product. He is the best finished and most classy looking horse in this country, not even excepting the Hackney. He, too, is really a selected thoroughbred. Denmark, a pure thoroughbred, being the foundation sire. It is said that the best blood is that of the Denmarks, but when it predominates it usually means five gaits. This is manifestly undesirable in the service. It is to be noted, however, that many saddlers do not take the "gaits" until schooled. The three gaited saddlers come for the most part from trotting families. The saddler excels as a high school and show horse. I had the privilege of attending the Blue Grass Fair held at Lexington, August 7th to 12th. It could very properly have been called a horse show, in which the saddler played far the most conspicuous part. The show rings were said to have been better this year than ever before, and they spoke volumes for the popularity of the saddler.

For cavalry purposes, the saddler is frequently too high at each end, too low in the middle, his hock action is often bad, and he cannot jump. However, he has great endurance, stamina, good temper, smooth and easy action, and I believe that thoroughbred grades on selected three gaited saddle mares would make wonderfully fine cavalry horses. Morgan's cavalry when it went out was probably the best mounted cavalry in the world. Their horses came from the blue grass country and were Lexingtons, Glencoes, and Denmarks, the thoroughbred blood that has given us some of our best present day thoroughbred and saddle bred families.

Through the courtesy of General John B. Castleman of Louisville, I was enabled to see a great deal of the saddle horse in Kentucky, as he furnished me with letters to all the more important breeders and owners. General Castleman is president of the American Saddle-horse Breeders' Association, and is a great lover of the breed. Probably to a greater extent than any other gentleman in the country, he is interested in and enthusiastic over the improvement of the army horse. He believes the saddler is the road to improvement and that he should be our cavalry horse. He admits that he cannot jump, but declares that the utility of jumping is questionable. However, so long as it seems necessary to maintain the Mounted Service School, and so long as it seems desirable, for various reasons, to keep officers and men interested in equitation and horsemanship,

just so long will it be necessary to mount them on horses that can jump and go across country. Moreover, the cavalry horse should be able to do this work when it is demanded of him. Consequently, it is my conviction that the cavalry horse should be more on the hunter type than the present saddle type, and no one has ever been heard to propose the saddler as a sire of hunters. It is always the thoroughbred.



DELHI.
Brown Stallion, foaled 1901.

By Ben Brush—Vera, by Imported Mortemer. Bred and owned by Mr. James R. Keene, Castleton Stud, Lexington, Ky. Winner of Belmont, Brooklyn Handicap, Great Republic. Hopeful, Withers and other stakes and of $115,640.00 in stake moneys. Height 16.1½, weight 1210, girth 75 in., cannon 8 in. Ideal charger type.

The Morgan.—The Morgan can hardly be considered at this time as a distinct breed. He has been swallowed up by the standard bred and by the saddler. At the present time no Morgan stallion possesses more than one-eighth of the blood of old Justin Morgan, and most of them have but 1-64. As a breed, therefore, the blood is not now fixed and consequently lacks prepotency. The old Morgan

was celebrated for his endurance and his intelligence. Some of the very best cavalry horses in the Civil War were Morgans. On account of low withers, the Morgan often has a bad back for the saddle. On account of their stout, blocky conformation, their endurance, and their intelligence, Morgan mares as the foundation of the thoroughbred grades would, I believe, produce cavalry horses of the very best type.

The *Virginia and Irish Hunters* are types, not breeds. They are thoroughbred grades. When compact instead of rangy, they are the type which we want for the trooper, and they are also the type that would be preferred by many officers, but being grades they are worthless as breeders. Pure bred sires are the only ones that have prepotency. A cross bred animal of any kind is almost always devoid of power to impress his individuality upon his offspring. Dr. A. S. Alexander's campaign for pure bred sires in Wisconsin is extremely interesting and convincing in this connection. Dr. Alexander is father of the "Stallion Law" movement that is now spreading from State to State.

By a process of elimination, therefore, and by reason of the fact that France, Germany, Russia, and other foreign governments have proved it, it is my conviction that the thoroughbred is the only horse that should be used as a sire of cavalry horses. It is to be noted that this horse has been bred the world over for speed, and unfortunately in many cases for speed alone. Some breeders have arrived at speed through a real deterioration of their stock, producing weeds and five-furlong rattle brained sprinters. Others have attained speed by consistently seeking to improve the horse. They breed for soundness, constitutional vigor, stamina, bone and substance and quite temper, letting speed come as a consequence of perfection. It is this method of breeding that has given us the world's greatest race horses.

As a result of the diversified methods of breeding, there is a greater diversity of type in the thoroughbred to-day than in any other breed of horses in the world. There are long ones, short ones, tall ones, low ones, wide ones, thin ones, compact ones, rangy ones, quiet ones, and crazy ones, all pure thoroughbred. The best type thoroughbred has greater endurance than any other breed. He has more courage and power, he is more intelligent, he is less excitable, he is a better jumper than any other horse, and besides this he is an animal of great individual beauty. The best type thoroughbred

is almost an ideal type for the army. On the other hand, the inferior types of the thoroughbred are the worst animals that the army could get hold of. A high class individual of proper conformation and of excellent temper may have resulted from the union of the best type horse with a weed mare. Suppose this horse is put in a rural stud to sire cavalry horses. At least half of his progeny will breed back to his dam, and the troop commander who draws the produce and has them running away in every charge, and sees that they lack every apparent qualification of a cavalry horse, will be condemning the judgment of the men who insisted on thoroughbred blood for the army.

But proper selections can be made, and in order to obtain *uniformity* and *excellence* I maintain that the thoroughbred is the only horse that should be used to sire cavalry horses. This being the case the government should place in "rural studs" *carefully bred and selected* thoroughbred stallions.

Any remount system to be successful must have for its object the encouragement of the small breeder. These small breeders must find it profitable to breed their approved mares to the selected government stallions, the government having a *refusal* on the colt, as a weanling, a yearling, a two or a three-year-old as seems cheapest and most desirable.

Upon the selection of the stallions for the "rural studs" *rests the marked success* or only the *mediocre success* of the whole scheme. To select them at random throughout the country on account of appearance and conformation alone, and probably getting the bad tempered ones because they are cheapest, would be to violate the corner-stone principle of successful breeding, i. e., that every animal breeds to his heritage, not to his own individuality. These stallions should be produced at the government "national stud" *under the careful supervision of an expert breeder*.

While in Lexington, I visited all of the important and many of the less important thoroughbred, saddle bred, and standard bred farms. I observed their methods of breeding, feeding and care, and to my mind the acme of perfection in all these things exists at Mr. J. R. Keene's Castleton Stud. For the last eighteen years Castleton has been under the sole charge of Major Foxhall A. Daingerfield, Mr. Keene's brother-in-law. During this time Major Daingerfield, who is now a man of 72 years of age, has confined his attention to breeding and rearing thoroughbreds. His

success has been phenomenal. In Kentucky he seems to be recognized by all horsemen as the greatest of breeders. He is a very close student of heredity, and he breeds in such a manner that heredity will assist, not thwart, his efforts. He does not favor two-year-old racing, believing that the breed suffers through the racing of immature animals. He has always bred for strength, stamina, constitutional vigor, and good temper, and in successfully breeding these qualities he has bred many of the country's greatest winners.

PETER PAN.

Bay Stallion, foaled 1904.

By Commando—Cinderella, by Hermit. Bred and owned by Mr. James K. Keene, Castleton Stud, Lexington, Ky. Winner of Belmont, Brighton Handicap, Brooklyn Derby, Hopeful, Tidal, Advance, Surf, and other stakes, and of $116,450.00 in stake moneys. Height 16.1¼, weight 1315, girth 75½ in., cannon 8 in. A big powerful horse.

The Major said to me: "I have always been a physical perfectionist, endeavoring to produce in every animal I bred a physically perfect type. I have sometimes heard racehorse men say 'that horse is too good looking to ever be a winner,' but it is my experience that I have never been able to breed a horse that was

ever stopped by his good looks. There is always something about a really great horse that will cause the eye of any horseman to take a second look at him."

In the eighteen years at Castleton, the Major has produced four generations of horses, or in other words, each of the colts and fillies now at Castleton is the result of something near fifteen careful matings made by Major Daingerfield, and the blood combinations which he aimed at so long ago are just now being effected, and are showing remarkable results. He says that he is just now getting ready to breed horses; that it has taken him about eighteen years to establish and perfect his type and get a substantial foundation for breeding. It must be observed that breeding horses is slow business, in that mistakes or successes are not apparent until several years have elapsed. If mistakes have been made, many more years are needed to correct them.

With each generation the Major has succeeded in increasing the excellence of his type; for instance, in a line from the great English Touchstone he began with Himyar. From Himyar he bred Domino who, with $193,550.00 to his credit, stands at the head of America's greatest winners. From Domino he bred Cap and Bells, the only American filly that has ever won the English Oaks, and Domino's son, Commando, has proved, in his stud performances, that he is as far superior to his sire as he in turn was superior to Himyar. In 1905, when seven years old, Commando succumbed to tetanus. Two years after his death he headed the list of winning sires in this country with $270,345.00, the greatest amount ever credited to a premier stallion in America. He bred Colin, Ballot, Peter Pan, and Delhi, all on the list of greatest American winners, with $180,912.00, $154,545.00, $116,450.00, and $115,640.00. credited to them respectively. Colin is now in the stud in England, and by many experts he is declared to be the best horse in that country. He stills belongs to Mr. Keene. Ballot,* Peter Pan, and Delhi, all superb animals, are now in the stud at Castleton and all are perfectly sound and unblemished, which is decidedly unusual for horses that have undergone the remarkable campaigning that they have. However, they would not be in the stud at Castleton if they were not perfectly sound. In many other studs sound stallions

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* Since this was written Ballot has been taken to England where he has joined Colin in the stud.

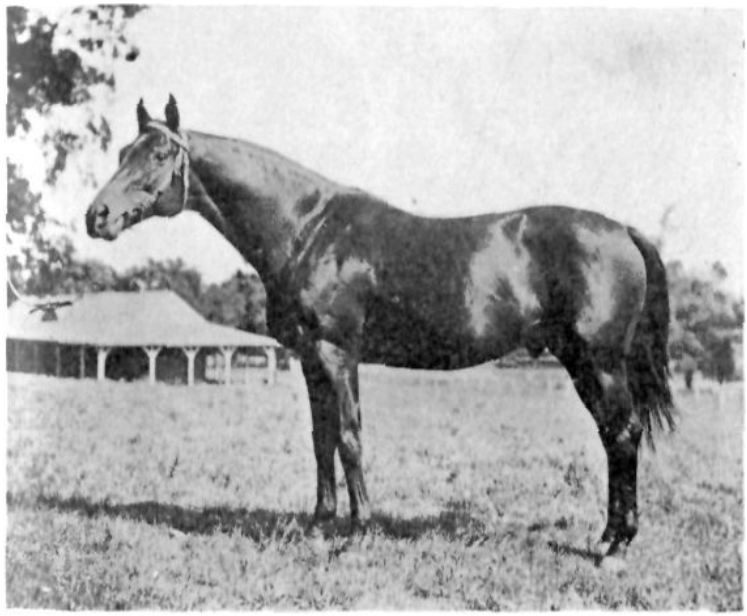
are not so rigidly insisted on. In one I saw a famous campaigner, but he had a bad curb (curby conformation) and an unusually bad ringbone. The predisposition to these unsoundnesses is transmissible.

For the last five years in succession Major Daingerfield has bred the winner of America's greatest race—the Futurity, run at Sheepshead Bay,—a record unparallelled in the world. In 1905, 1906, 1907 and 1908, he bred the horses that placed Mr. Keene at the head of the list of winning owners in this country, and in 1907, with $406,591.00 to their credit, the Castleton bred horses made Mr. Keene the record winning owner of the world. The next largest winning owner is the Duke of Portland, who in 1889 won on the English turf $365,782.63. The winnings of the farm have exceeded the enormous sum of $2,000,000.00. This result is much more striking when it is known that at no time in its history has the stud at Castleton exceeded 87 mares. In 1907 many studs in the United States, especially Kentucky, had 500 or 600 mares. It is still more striking when it is known that in no season has Mr. Keene retained more than half of his yearlings. Of course, he turned off the ones he considered the least promising, but amongst the ones he turned off were almost always some of his most formidable competitors. Chief amongst these, perhaps, have been Trance, Rose Queen, and Novelty.

In 1909 Mr. Keene's best horses were in England or in all probability he would have again headed the list of winning owners instead of being number two. In 1910 Mr. Keene sold to Mr. Hildreth a colt named Novelty. This colt was bred at Castleton by Major Daingerfield. During the year he was winner of over $70,000.00. The winnings of Novelty would have placed any one of ten winning owners at the top of the list. Mr. Keene also had his best horses in England again in 1910.

I have gone into this subject at some length because I wished to clearly show why Major Daingerfield is to-day considered the most expert breeder of thoroughbreds in the world. Every horse bred at Castleton has been entirely due to his ideas of mating. It was my privilege while at Castleton to see the 57 yearlings (27 colts and 30 fillies) that had just been sold to Mr. Harry Payne Whitney. Such a superb bunch of animals could hardly be imagined. Their uniformity was something remarkable, and there

was not a scrub in the lot. These 57 colts represented the entire output of Castleton for this year. Twelve of the colts and ten of the fillies are to be entered by Mr. Whitney in the English classics. They were so uniform in excellence that after two or three days' study Mr. Rowe, the man who is to train them for Mr. Whitney, said "If I



ROCK SAND.

Brown Stallion, foaled 1900.

By Sainfoin—Roqueburne by St. Simon. Bred in England by Sir J. Miller. Imported and owned by Mr. August Belmont, Nursery Stud, Lexington, Ky. Started 20 times. Won 16 races. Placed 2d once and 3d three times. Winner of Two Thousand Guineas, Derby, St. Leger, and other important stakes and of the equivalent of $250,848.00 in stake moneys. Height 15.3½, weight 1180, girth 74½, cannon 7¾.

should pick 20 from the 27 colts, I would not be at all satisfied that I had not left the crack in the discard. If they do not win the classics it will be our fault." It will be interesting to watch the records of these colts in England, for I do not well see how animals of greater excellence could be produced.

The persistent rumor that Mr. Keene is going to quit the turf and sell his Castleton stud is gaining credence.* It is thought that his stallions and mares may be taken to England, where on account of better racing conditions, they will have a greater value than in this country. It would be a misfortune and a serious loss to the American thoroughbred to have this stud sold at auction and its excellence dissipated to say nothing of having it removed entirely from the country.

If such a piece of good fortune might befall us as to have this stud become the property of the United States Government, it would mean that the very best thoroughbred blood in the world had been placed at our disposal for the improvement of the army horse, and it would mean that twenty or more years had been gained in the establishment of an effective remount system. This latter statement is made because I am positive that no one, not even a man intimately familiar with thoroughbred blood lines and families, could select thoroughbreds at random and build up inside of twenty years the excellence that Major Daingerfield has built up and that now exists at Castleton. Every one of his stallions has conformation, bone, substance, and good temper. The thorough bred sprinter and weed, either mare or stallion, is not in the paddocks at this stud, nor is he in the recent ancestry of these superb animals.

It is a matter of general remark at Lexington that the Castleton stallions are as quiet as geldings. This result, not altogether apparent in any other stud that I saw, is attributable both to breeding and to Major Daingerfield's superior methods of handling. The Major, having such an intimate knowledge of thoroughbred families, will never mate, for instance, a stallion having a strain of Galopin or his son St. Simon with a mare having the same strain because he knows that the Galopins are bad tempered, and that such a mating would intensify the undesirable character. He studies pedigrees and breeds away from other undesirable characters and breeds to or intensifies, or concentrates, the good characters. Unlike many pedigree breeders, however, he is not blind to every thing in a pedigree except speed, and furthermore, he never breeds to a faulty individual no matter if his pedigree be the finest. He is both scientific and practical.

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* Since this article was written Mr. Keene has sold his Castleton farm his horses, however, have not yet been disposed of.

As regards the handling of his stallions, the Major has them ridden every day (something that is not done at any other stud that I saw), they are turned in paddocks where they can see each other and they are kept in stalls where they can see each other. The Major stated "The horse is a gregarious animal and likes to see his kind. Put him (the stallion) away from other animals where he will get lonesome, and you will make a vicious and uncontrollable brute out of him."

I was particularly interested in the stallion Ultimus (Commando's last), in whose breeding Major Daingerfield concentrated a number of strains noted for strength. This horse's photograph, weight, and measurements show in a degree what a remarkable animal he is. The muscles on the inside of his arms and second thighs stand out almost to deformity. The width between his jaws, point to point, is 6¾ inches, conspicuously wider than in any other horse I have ever seen, and it gives his head a peculiarly bulldog looking expression. He is very masculine (an effeminate stallion and masculine mare are always to be avoided in breeding) and he is powerful enough for an artillery horse. He is conspicuously wide between the eyes as are all the Castleton stallions. Many gentlemen from England, Germany, and this country, have stated to Major Daingerfield that this horse is the most heavily muscled thoroughbred they have ever seen. Ultimus' first colts are now weanlings, and it appears from these colts that he is going to be a very impressive sire.

Sickness amongst the horses at Castleton is almost unheard of. The Major stated to me that he had not had a veterinary bill for something over a year. All stables and sheds are inexpensively constructed in such a way that they are merely shelters from wind and storm. The temperature is always what it is out of doors, and no blanketing or pampering is done. Lots of fresh air and exercise and always plenty of nourishing food, the Major declares to be the secret of keeping his horses healthy and hardy.

Castleton as our National Stud, and Major Daingerfield in control as long as his services could be secured, would give a remount system in this country a foundation that would mean great future success. The 27 colts purchased by Mr. Whitney would, on account of their size, vigor, uniformity, and intensity of breeding, make government stallions, that could not be surpassed in the world.

Their breeding is such that they would be impressive and of certain prepotence over any mares with which they would be mated to produce cavalry horses.

The Mounted Service School would make the ideal "trying out" place for the most promising animals produced at the government stud. Although a matter of dispute among scientists, it seems to be

FAIR PLAY.

Chestnut Stallion, foaled 1905.

By Hastings—Imported Fairy Gold by Bend Or. Bred and owned by Mr. August Belmont, Nursery Stud, Lexington, Ky. Winner of Brooklyn Derby, Jerome Handicap, Withers, Lawrence, Realization, Flash, and other stakes, and of $86,950.00 in stake moneys. Height 16.0¾, weight 1180, girth 74 in, cannon 8 in.

generally conceded by practical men that best results are obtained by training an animal in the work in which it is desired that his produce excel. The most frequently cited example of this fact is that of Mambrino Chief, by Mambrino Paymaster. This horse "had already been used as a stallion for breeding of trotters before he was trained for trotting races. He produced badly, however, and his progeny were not able to win any trotting races.

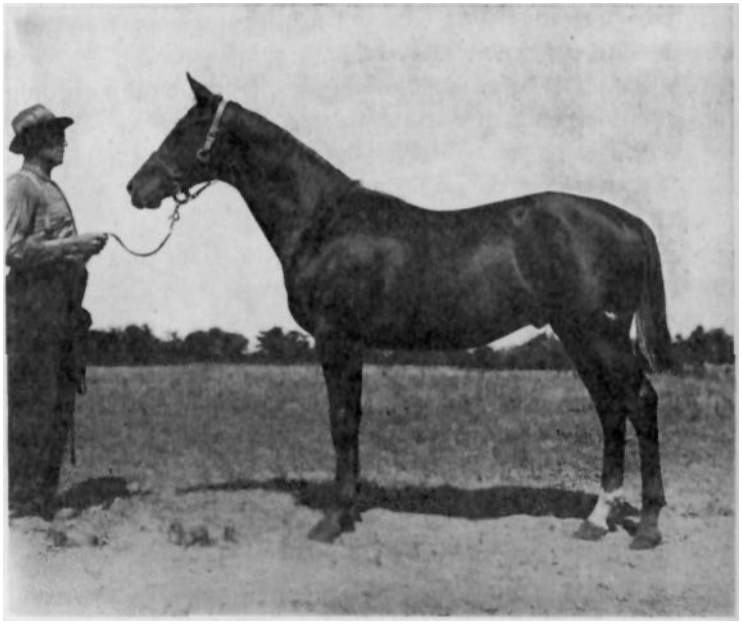
He was then trained several years for trotting, and afterwards transmitted so well the faculty for trotting that he became one of the favorite trotting sires in Kentucky."

At the end of the two years' training at the Mounted Service School the best fillies should be returned to the stud, the best colts sent out as government stallions, and all others sold to officers or otherwise disposed of at the School. The Mounted Service School and a government stud (especially if located together at some place like Front Royal, Va.) could easily co-operate in such a way as to furnish far reaching benefits to the school and at the same time afford untold advantages to a national breeding bureau. The school badly needs better horses. Selected officers from the Mounted Service School mounted on such horses as those put out by Castleton this year, would insure success for us in any international competition we chose to enter, and in my opinion entries in such competitions are to be encouraged as far as possible. It means greater interest in horsemanship throughout the Army. Success in such events means popular pride in our army horsemen.

Mr. Swan, the stud manager at Mr. J. B. Haggin's Elmendorf Farm, remarked to me, "The government, if it should start a breeding farm, could make no greater mistake than considering that every thoroughbred was well enough bred to breed from for cavalry purposes. A man should be sent to do just what you are doing now—make a practical study of the various blood lines. Some lines have constitutional unsoundnesses, some are weak in point of conformation and size, while others are quite the reverse. One of the greatest points to be considered is that of temper. You want the best possible tempers in army horses. The Galopins, while frequently to all outward appearances very docile, yet go to ship them and they will kick their stalls to pieces; in the breeding season the stallions go right down in flesh. They paw and thrash around in their stalls like tigers, and they are almost as dangerous as tigers, too. Their colts, when you go to handle them as little fellows, will kick you, bite you, strike you, or do anything, and they are frantic at the post when raced. But they are awfully fast and that is why they are bred. The Galopins (St. Simons) are carrying everything in England now. No mare nor stallion should be admitted to a government stud unless of good temper, and unless the good tempered lines in their pedigrees outweigh

the hot tempered ones." Mr. Swan has been handling thoroughbred stallions for Mr. Haggin for over 25 years and he has had experience with an unusual number of Galopins.

I visited Mr. John E. Madden's "Hamburg Place." Mr. Madden is reputed to be one of the most shrewd and successful horse breeders in the Blue Grass Country. He breeds both thoroughbreds and standard breds. His stallions and mares are animals that have made good on the race course and have come from it perfectly sound. He has some superior thoroughbred stallions, but on account of the conditions in this country he said to me that he was considering sending them abroad for sale.



CHESTNUT COLT.

By Delhi—Dominoes by Domino. Age 16 mos., height 15.0½, weight 1040.

I visited the Patchen Wilkes Stock Farm. This is one of the largest standard bred farms in the United States, and is owned by Mr. W. E. D. Stokes. The 1910 catalogue shows 13 stallions and 161 brood mares. At the head of the stud is Peter the Great, one of the most famous present day sires of trotting speed. He

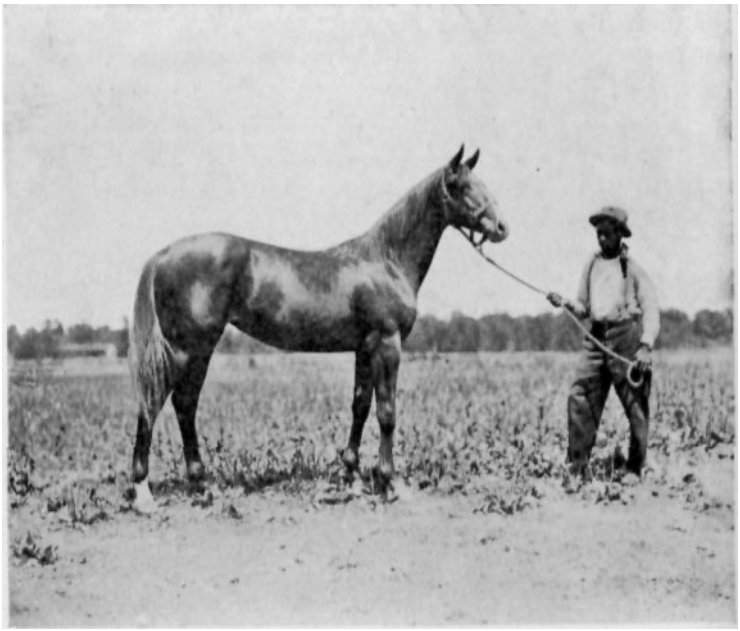
is an unusually handsome animal, a standard bred that has conformation. He is a type that would be of service in improving the army horse.

On account of Mr. August Belmont's enthusiastic public spirit and generous interest in the Army, I was very anxious to see and was much interested in his "Nursery Stud." The animals in Mr. Belmont's stud represent an enormous outlay of money. For the second time in its history this famous stud has a Derby winner at its head. The present one, Rock Sand, is not only a Derby winner, but is also one of the nine horses in history that have won the triple crown. He is pronounced by English critics as the best bred horse that ever won these three classics. He was imported by Mr. Belmont at a cost of $125,000.00. But one other horse, Ormonde, himself a triple crown winner, was ever imported to this country at a cost exceeding that of Rock Sand. Rock Sand is of excellent temperament, as kind and gentle as a dog. He started twenty times and won over $250,000.00 on the English turf, yet is absolutely sound and without a mark. He is a beautiful horse, and would be of great value to a government principal stud. Hastings, next to Rock Sand, is the most highly prized stallion in Mr. Belmont's stud. He is valued largely on account of the fact that he was an unusually game race horse, but chiefly, I think, on account of the fact that he is a very promising scion of a dying line. The Matchem line, weak everywhere, exists in this country only through Hastings, Lamplighter, Major Daingerfield's Kingston, and Mr. Madden's Ogden. All of these horses have been given every chance at the stud, for breeders are most anxious to preserve the line. Last year Kingston headed the list of winning sires in America and Hastings was number two. Hastings headed the list in 1902.

The stallion I liked best at the Nursery was Fair Play by Hastings out of imported Fairy Gold by Bend Or. His dam was imported by Mr. Belmont at a very long price. Fair Play is as perfect an individual as any horse I have ever seen. I could not criticize a single point in his conformation or appearance. He was one of the great race horses of this country, and, it seemed to me, a shining example of Major Daingerfield's assertion that the best race horses are, as a rule, the best looking individuals.

THE ARTILLERY HORSE.

The Artillery horse should be good at the walk, trot, and gallop; he must be a weight carrier, and a draft horse. He should weigh not under 1,150 pounds in condition. If he is much smaller his muscles will have too much work to do, work that could be done more easily by a horse that could throw more weight into the collar. He should



CHESTNUT FILLY.

By Peter Pan—Dazzling. Age 16 mos., height 15.0¾.

weigh little if any more than 1,300 pounds. A larger horse means an increase of clumsiness with a corresponding decrease in speed and activity; it means more horse to feed and groom, more horse to get tired, a horse with decreased powers of recuperation. He should be stoutly and compactly built. His legs should be short, with good bone, tendon and muscle. The rawboned rangy horse with weak stiltlike legs, long back, and loose flank (usual characteristic of a poor feeder) is a horse to be avoided for artillery purposes. The Artillery horse should be above the average in intelligence, and of a quiet, kindly, and docile temperament.

In considering how the artillery horse should be bred, it is well to take a look at the breeds we have to work on. The breeds recognized by the U. S. Department of Agriculture are the following: the numbers following each breed refer to the number of animals registered, or registered and living (from report, Bureau Animal Industry, 1909):

Saddle Type.

Arabian	No Record.
Thoroughbred	35,000 Living.
(T) Saddle	7,267 Living.

Light Harness Type.

(T) Standard Bred	220,920 Registered.
(T) Morgan	4,200 Living.
(T) Hackney	3,362 Registered.

Heavy Harness Type.

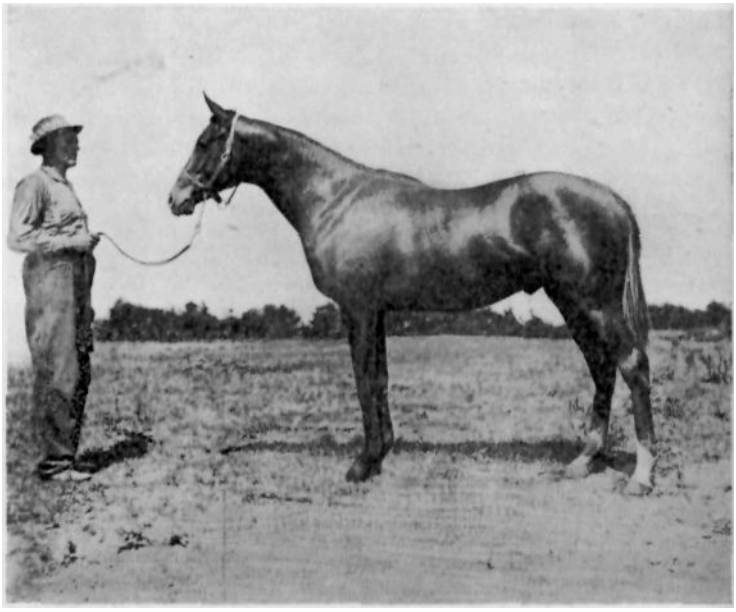
(T) French Coach	2,121 Living.
(T) German Coach	2,886 Registered.
(T) Cleveland Bay	1,450 Living.

Draft Type.

(T) Percheron	46,000 Living.
French Draft (Old Norman)	13,500 Living.
Clydesdale	14,391 Registered.
Shire	3,850 Living.
Belgian Draft	5,160 Living.
Suffolk	190 Living.

Total number of breeds, 15. The ones having T in front of the name are the ones whose improvement has been due to thoroughbred blood. Not one of the breeds mentioned can lay claim to being an ideal artillery horse. For the latter, all of the draft type can be dismissed from consideration because they are too heavy. For siege artillery, however, it would be hard to find a horse superior to the Percheron. He weighs from 1,600 to 2,000 lbs., and he has better action than any of the other draft breeds. Pure Percherons have been known to trot a mile in 3 minutes. The Percheron is almost always the circus

horse because of his action and his intelligence. Furthermore, the Percheron is the most popular draft breed in this country. We would not have to establish a bureau to encourage his breeding. He does not have the long hair (feather) on the legs that the Shires and Clydesdales have. The Superintendent of Transportation at the Armour Packing Company, Kansas City, Mo., informed me that foot and leg troubles were much less common with his Percherons than with his Shires and Clydesdales.



CHESTNUT COLT.

By Voter—Running Stream by Domino. Age 16 mos., height 15.2, weight 975.

The best type French Coach (weighing from 1250 to 1400 pounds) would at first thought seem promising to breed for artillery purposes. He is a beautiful animal, but unfortunately he does not breed true to type. He does not seem to possess breed prepotency, and his grades on native mares are almost always misfits.

For this reason he has never attained a high degree of popularity in this country. Furthermore, coachmen prefer large standard bred horses because they have much more speed, stamina, and endurance.

The German Coach is too heavy, and neither he nor the Cleveland Bay are popular enough to breed for artillery purposes.

Of the remaining breeds, there is the Hackney that has frequently taken the prize in Canada as the typical artillery horse. The Hackney, however, has a fatal defect. He does not have endurance. He is a beautiful animal and a superb Madison Square Garden horse, but he is out of his sphere when it comes to hard work.

On account of the old Morgan's reputation for endurance and hardiness, exhaustive trial would be demanded for him. However, in my opinion, he would not make a satisfactory artillery horse because he is too small. He averages about 15 hands in height and 900 to 1000 pounds in weight.

The American breeds that have the greatest stamina and endurance are the Thoroughbred, the Standard Bred, and the Saddler. None have for generations upon generations been required to undergo and to withstand the severe strains of the race couse that the first two have, and the saddler combines their blood. It will, of course, be argued that the race track has led to the production of a horse that is utterly worthless elsewhere, especially in the Army. That this is true in a vast number of individual cases no one will deny, but to declare that it is true in all cases or for the breeds as a whole, is but a declaration of prejudice. These three breeds, in my opinion, contain the best blood for the army, both for cavalry and artillery. Each one has been modified through selection until it excels in its particular place. Each is susceptible of further modification through selection, and a government stud could, within a few generations, mold from these breeds a cavalry type and an artillery type that would be unexcelled, and the goal would not be so far distant as if other breeds were selected for foundation stock.

The thoroughbred, of course, is in no sense a draft horse, and his use for artillery is out of the question. The selected standard bred of bone, muscle, and size would make an excellent artillery horse, but I believe that the selected three-gaited saddler would be even better, for he is more of a combination horse than is the standard bred. He is a better weight carrier, he cannot trot quite so fast, but he is a better walker and is much smoother at the gallop. He is a happy combination of thoroughbred, standard bred, and Morgan blood. The three-gaited saddle family is really a trotting family. Messenger, a pure thoroughbred, was the grandsire (in male line) of Hambletonian 10, the most prepotent sire of trotting speed the

world has ever seen. Messenger was also the g. g. g. grandsire (in male line) of Harrison Chief, one of the most famous saddle horse sires that Kentucky has ever seen. Harrison Chief got two great sons in Wilson's King and Bourbon Chief.

Bourbon Chief got Montgomery Chief, Bourbon King, and Emerald Chief, all horses of the very first rank, while Wilson's King got two sensational sires in Cloud King and Golden King. In the show rings of this country the King and Chief blood has been phenomenally successful when shown in either saddle or combination classes.

CHESTNUT FILLY.

By Disguise—Seeress. Age 16 mos., height 15.1½.

It was my pleasure to visit the Emerald Chief Stock Farm at Mount Sterling, Ky., the home of Golden King. I had heard a great deal about this horse and about the work of his breeder and owner, Mr. J. Gano Johnson.

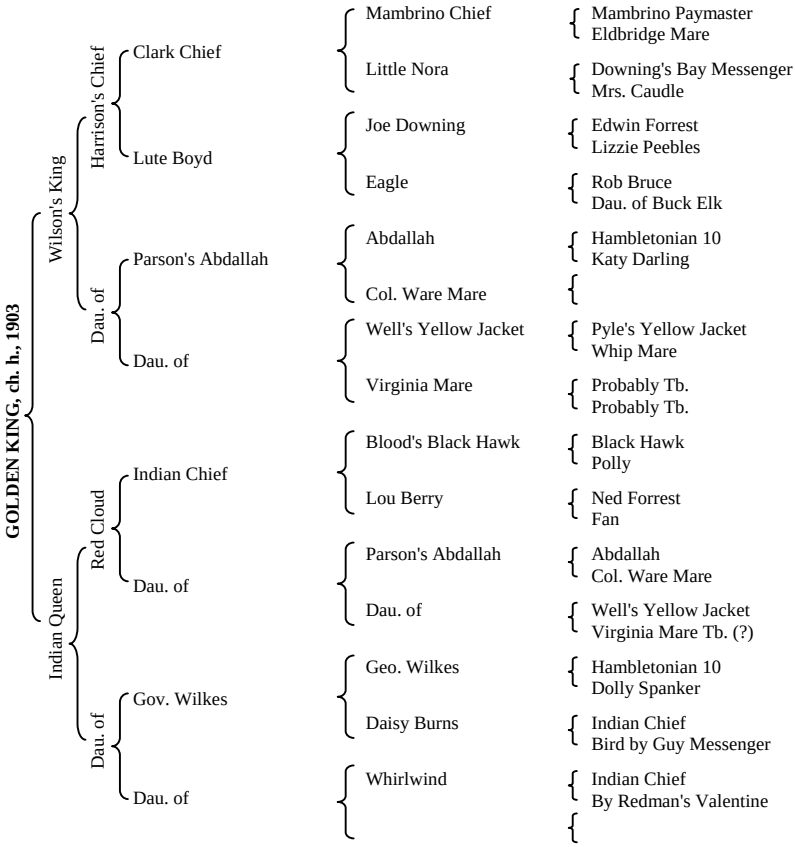
Mr. Johnson, like Major Daingerfield, is a deep and earnest student of heredity, and like him practically a life's work has been

spent in building a foundation, in arriving at his ideal. I was struck with the similarity of the roads the two men have traveled in attaining success. Both have bred their great animals through intense inbreeding—cross breeding and dissipating the defects, inbreeding and intensifying the desirable characters. So far as I have been able to determine, Mr. Johnson is the only breeder in this country who has endeavored to produce a pure type of horse according to the Mendelian theory; yet to him belongs the credit of having initiated this work over twenty years before Mendelism was rediscovered in 1900, so that he did not have Mendel as a guide. When a young man, Mr. Johnson argued that as there were plenty of species of plants and animals that bred true to type it must be within the bounds of possibility to produce a saddle horse that would breed true to type. An inspection of his animals is sufficient to convince the most critical observer that he has been successful. His animals are strikingly alike in all important characteristics. He enthusiastically declares that in a few more generations he will have them "as much alike as flies." Seeing what he has already accomplished, this is not hard to believe. He has what he calls "pure breds" and "half breds," and these he pointed out to me in his various paddocks. The "pure breds" are the ones in which he has eliminated all undesirable blood, or bred it out so far that it is not strong enough to revert and injure his type. He calls them the ones in which his perfected conformation, gaits, temper, etc., have been made dominant and thus prepotent. The "half breds" are the ones in which the crossing out of undesirable characters is not yet completed.

At the Blue Grass Fair this year, Young Bill and Golden Girl, both by Golden King, and both bred by Mr. Johnson, were shown in combination classes. They easily won in large fields and were enthusiastically declared by many horsemen to be the "sensations" of the fair. Their most conspicuous point of excellence lay in their straight, true, and elastic action, every foot being planted at the proper time and in the proper place.

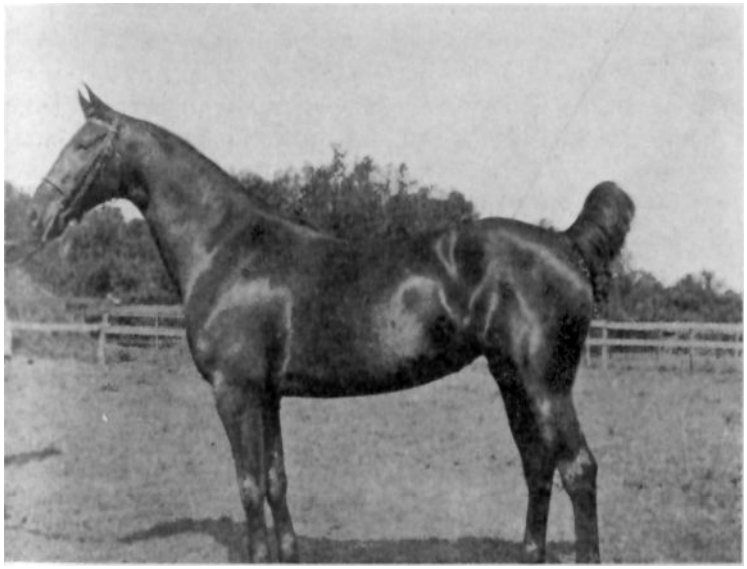
Golden King is at the head of the Emerald Chief Stud. This animal has been adjudged by many expert horsemen as perfect. His striking qualities are his docility and intelligence, and his easy, true, and faultless action. I was particularly impressed by the great bone, and big strong joints of his legs, his perfect knees, hocks, and feet, and by his symmetry and beauty. He stands 15.3 and weighs 1200

pounds; he is a big, powerful horse on short, perfect legs. His pedigree, which follows, is an interesting study:



It will be seen that he is inbred to the wonderful mare that produced two of Kentucky's greatest horses—Wilson's King and Red Cloud. It has been written of this mare, "Mr. Arrasmith calls her trot a Black Hawk trot. She would go freely all day in harness without whip, raising her knees and hocks to a line with her body, lightly touching the ground, without paddle or interference. He attributes the fold of knee and line trot of the Kings and Red Clouds to this great mare, dam of both." It will be observed that this mare was by Parson's Abdallah, a grandson of the great Hambletonian 10. By inbreeding to this mare, therefore, speed, faultless and elastic action, and endurance have been intensified in Golden King. He has these qualities. Speed is further intensified through

the sire, Wilson's King, who, it will be seen, was inbred to the same trotting line. Golden King's dam, Indian Queen, it will be observed, was closely inbred to and had three crosses of Indian Chief, of whom it has been said "the greatest harness stallion Kentucky has ever had within her borders." In Indian Queen, as a consequence, beauty and symmetry of conformation, keen eye, sensitive ear, intelligence and docility were intensified and made prepotent.



NATOMA
Bay Mare, foaled 1907.

By Eric Chief (Saddler). Dam by George Simmons (trotter). Height 15.3, weight 1175, girth 74 in. An excellent type for artillery.

Indian Chief is a great great grandson of Justin Morgan, the foundation sire of the Morgan horse in this country. Mr. Johnson's horses therefore combine the Standard bred, Thoroughbred and Morgan blood, which I consider theoretically perfect for the artillery horse.

The King and Chief blood of the saddle horse, especially as it exists in Mr. Johnson's animals, would, in my opinion, be the best possible blood to put in a government stud out of which to mold the ideal artillery type. Careful selection would produce a horse a little larger and heavier and a horse that carried his head a little

lower; and if this were done it would seem that nothing could be left to be desired. This blood would "nick" unusually well with that of the Standard bred because of the close relationship existing between the two. These stallions, graded on large, well-made standard mares, carefully selected as being of artillery type, would produce the finest artillery horses in the world, and the farther the grade was carried (three, four and five top crosses) the better would be the result.

In this connection it might be stated that *crosses* are never satisfactory. There is no uniformity in a cross. The two bloods never exactly blend, sometimes the progeny resembles the sire, other times the dam, depending upon which parent has the purer blood with its attendant prepotency (the best reason why we should have intensely bred sires of certain prepotency to put in rural studs).

The measure of uniformity in transmission (prepotency) is great: *1*. In proportion to the time during which the animals have been bred pure (the thoroughbred, having been bred pure longer than any other breed, the Arabian excepted, is to-day universally considered as having greater prepotency than any other breed of horses). *2*. In proportion to the closeness to the blood relationship of the parents (a justification for skilful inbreeding—skilful because by inbreeding defects are intensified just as certainly as good points). *3*. In proportion to the nearness of the resemblance of parents to one another, in structure and form, and in all leading characteristics (one of the best reasons why the mares to be mated with cavalry type thoroughbreds in rural studs should be selected as being of cavalry type and conformation if the produce is wanted for the cavalry).

It is only with grades of two, three, four, or more top crosses that uniformity can be secured.

The photograph of Natoma shows a superb type artillery mare. She happens to be a cross, but this cross is the first step toward the proper kind of a grade for the artillery service, and that this mare is an excellent individual shows how well the blood "nicks" in crossing the breeds represented. She is by Eric Chief, son of Harrison Chief, and is out of a standard bred mare. She is owned by Mr. C. L. Railey, Lexington, Ky., and I did not know until after I had selected her as one of the best types for artillery that I saw in Kentucky, that she was bred the way I believed the artillery horse should be bred.

It is perhaps idle to express an opinion about the breed of horses that most nearly meets the requirements of the artillery service, for in the absence of exhaustive tests to determine this fact, any statement is at best but an opinion, and an opinion that may be shared by but few artillery officers and not at all by the civilian fanciers of the breeds discarded. It would seem that the artillery might and probably would derive no little profit from a prolonged test that would fairly and thoroughly measure and compare the merits of the Saddler, the Standard bred, the Morgan, the Hackney, and the three Coach breeds for the artillery service. Such a test could, if necessary, be made by a single battery, as one section of horses would furnish a sufficient number of representatives of each breed to afford data upon which to base reliable conclusions. It would be worse than useless to test anything but pure breds or very high grades, for two reasons, first, because every effort is now being made throughout the country to educate farmers through the use of nothing but sound, pure bred, sires to stop breeding mongrels, and second, because a mongrel is excellent by chance and his excellence cannot be duplicated even by another mating of his own sire and dam. In other words, it would do us no good to establish the excellence of any horse unless we could breed other horses like him.

Our army horses will never approach uniformity in conformation, type, quality, action, endurance, stamina, temperament, or other essential characters until a high degree of *uniformity in breeding* is attained. The government must seek to control and improve the type. To do this, no more effective plan could be adopted than that of breeding rural stallions at one or more government studs, and these from the best blood that the nation could buy. A careful selection of colts so produced would furnish rural districts ("communities" or "circuits") with *pure bred sires of a type* and sires that when mated with selected and approved mares would *breed to a type*. The type and quality of our cavalry and artillery horses would thus be controlled and improved through the control and improvement of their sires at the government stud.

The government stud should be under the management of the Agricultural Department. The great work this department is doing through its Bureau of Animal Industry would be an assurance to horse breeders throughout the country that the scheme was going to be pushed to success.

With the mares and stallions entering into the government breeding scheme, a government stud book should be prepared. This could be very easily done, its cost would be negligible, and its value would increase from year to year. It would probably be very desirable to publish it to the service from time to time (about once every four years). On the descriptive cards of all horses sent to the remount depots, and later to organizations, should be recorded the animal's "U. S. government" sire and "U. S. government approved" dam. The breeding of the animals would thus more and more catch the eye of troop and battery commanders, and I. and I. Reports coming back to the national stud would show with unerring accuracy where and what the weaknesses were, what lines to breed from, what lines to breed to, and other data of inestimable value to the practical breeding business at the national and rural studs. Such a record would attain a degree of excellence that is impossible in the ordinary stud or herd book where undesirable individuals are eliminated with difficulty or not at all. No breed of animals in the world has improved without the stud or herd book, but the government stud book could be of considerably greater value, in that all animals destined for breeding purposes would be subjected to a rigid inspection, and if found defective they would be denied registration. I believe that this would be one of the greatest factors contributing to the establishment and improvement of cavalry and artillery types. Without some such plan we could breed for years and years without effecting perceptible improvement. The stud book record would in time show positively what breed of mares made the best foundation for grading. It would also show what number of top crosses were best.

Our army remount scheme must be something more than a plan to benefit the army alone. It cannot prosper or even exist on such a basis. It must be in sympathy with, and look to, the broader interests of the country. It can and should be made a means of educating and instructing farmers and breeders in the industrial and commercial benefits to be derived from improved methods of breeding. The wonderful laws of Mendel, rediscovered and given to the world in 1900 by De Vries, have awakened scientists the world over to the wonderful possibilities of breeding better plants, animals, and even men. Mendelism is just beginning to reach the lay mind, and the interest it is awakening in eugenics alone bids fair to sweep the nation and perhaps the world.

A government stud organized as an experiment station under the Department of Agriculture would be in keeping with this spirit of improvement. It would, on account of its permanency and its records, become the source of authoritative information on all phases of animal breeding and heredity. Its value to our agricultural colleges and to the breeding interests of the entire nation would soon be strongly felt. It would be in sympathy with, and co-operate in, the work recently undertaken by the American Breeders Association, organized in Washington in 1910, "for the purpose of instructing breeders in all the phases of heredity of plants, animals and men, and for the improvement of methods of breeding."

Incidental to this the government stud would produce and fix a type of army horse that would do credit to the nation and be unsurpassed for the purpose.

NOTES ON THE COURSE AT THE SCHOOL OF FIRE.

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

(CONTINUED FROM JUNE NUMBER.)

TWENTY-THIRD EXERCISE.

Field work,—panoramic sketching, followed by actual firing (Practice Report No. 1)

School Practice No. 1.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. March 19, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2500	German battery, 6 guns, 6 caissons, 1 observing caisson & 54 figures sight defilade	54	8	20	6	0	4′ 21″ (4′ 21″)
2	2500	German battery, 6 guns, 6 caissons, 1 observing ladder & 54 figures.	54	0	0	9 n. b.	0	3′ 35″ (3′ 35″)
3	2500	Infantry trench.	0	0	0	9	0	4′ (4′)

Shell, Nitro Cellulose Powder, Picatinny Arsenal, Lot 1, 1908, 3″ Field Guns, Models of 1902, 1904 and 1905. Charge 24⅞ ozs. M. V. 1640 F. S. Pressure 27300 pounds, 110 gr. percussion primer and ¼ oz. igniter.

Critique.—First officer's firing.—Commands transmitted in improper sequence and with some confusion. Adjusting piece changed and changed back again. Error in first deflection too great. The double change in adjusting piece was due to erroneous information as to least range at which left piece would clear crest, error being later corrected. Use of left piece was desirable because B. C. station was so near right gun that dust and smoke endangered observation of impacts. Deflection error apparently greater than it actually was, left piece being used against most visible portion of

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
4	A.P., A.S. 298, D. 2765—9, L pi adj pi				
	Shell, R pi adj pi., L pi adj pi.	1	2400	? left	— 375
4	Subt. 50	2	2400	—	— 400
4	Subt. 25	3	2800	—	— 225
4		4	3200	+	+ 40
4		5	3000	—	— 85
4	Add 5	6	3100	—	Target.
	No. 2.				
1	A.P., 3rd pi adj pi., D.2340-5, A.S. 303				
	Shell	7	3200	+ left	+637
1	Subt. 20	8	2800	—	+ 272
1		9	3000	+	+ 493
1		10	2900	+	+ 433
1		11	2850	Target	+ 322
4	By battery from right	12	2850	—	+ 306
3		13	"	—	+ 255
2		14	"	—	+ 365
1		15	"	—	+ 382
	No. 3.				
4	A.P., R pi adj pi., D.2280-5, A.S. 300, Shell	16	3000	? left	+ 440
4	Subt. 20	17	3000	+	+ 538
4		18	2600	+	+ 80
4	Subt. 10	19	2400	—	— 128
4		20	2600	+	+ 16
4		21	2500	—	— 72
1	All the guns. V.F. 1 rd	22	2550	—	— 48
2	*				
3		23	"	—	— 48
4		24	"	+	Target.

* Out of action.

target, which was the right; there being an error in deflection difference, this was multiplied for the left piece.

Second officer's firing.—Failure to obtain bracket and therefore to solve problem. Observation based on sensing shots whose smoke appeared between sections of target; slightly erroneous deflection and deflection difference were not corrected, hence the faulty observation. First observation "plus left" was a dangerous, although in this case correct, one.

Third officer's firing.—Officer ventured change of range of 200 yards, which, while it proved that his judgment of previous shot as to distance over was correct, was not good practice. Shot at 2400 yards was apparently so far short that he doubted the correctness of his previous observation, and fired again at 2600.

TWENTY-FOURTH EXERCISE.

Field work,—panoramic sketching with time allowance of five minutes; identifying and locating on sketch five widely distributed

batteries, machine gun battery, and several lines of infantry, some targets being in open and others difficult to see. Simulated fire with a battery followed. Practice was given in changing from target being fired upon to a battery coming into position; principal point brought out was necessity of getting effect without a moment's unnecessary delay; to bring battery under fire before unlimbered required quick bracket of 400 yards, and immediate walking through.

Lecture room session.—Various questions discussed: among others, proper distribution of fire when an observation ladder or station is near a battery taken as target. The importance of crippling such a station and putting battery commander out of action indicate beyond doubt that distribution should be made to include station. Advantage all the more apparent if battery and battalion commanders happened to be at same station. Point was made of necessity of placing battery at least 200 yards in rear of crest if reasonable protection against all gun fire is desired.

Question of shields for machine guns was brought up. It was shown that increased visibility would not be compensated for by protection afforded; machine gun battery is hard target upon which to distribute, it is so nearly invisible as to be very hard to find, when found it is hard to indicate it to gunners for direct fire, observation of fire against it is uncertain, and successful attack requires large amount of ammunition.

Another question was whether, in fire for demolition of a gun battery, it is better to concentrate on one gun at a time or distribute. Conclusion was in favor of distribution. The difficulties of observing concentrated fire are great; ammunition varies slightly from round to round, and there are variations in guns, sights, etc., which necessitate slight changes between guns; four shots from one gun give less dispersion that one shot from each of four guns, so that probability of each gun hitting its own target is greater. With distributed fire all of the enemy's personnel is under fire, and there is less opportunity for him to withdraw and save part of matériel or personnel.

TWENTY-FIFTH EXERCISE.

Field work,—panoramic sketching, and actual firing (Practice Report No. 2).

School Practice No. 2.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. March 21, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2600	German battery, 6 guns, 6 caissons, 1 observing caisson & 54 figures	54	None	None	13	0	15′
2	2700	German battery, 6 guns, 6 caissons, 1 observing ladder & 54 figures	54	None	None	14	0	10′ 15″
3	2600	German battery, 6 guns, 6 caissons, 1 observing caisson & 54 men.	54	None	None	13	0	10′

Shell, Nitro Cellulose Powder, Picatinny Arsenal, Lot 1, 1908, 3″ Field Guns, Models 1902, 1904 and 1905. Charge 24⅞ ozs. M. V. 1640 F. S. Pressure 27300 pounds, 110 grain percussion primer and ¼ oz. igniter.

Critique.—None of the problems was solved by determination of a correct bracket. In the case of the first officer, first position selected was unsuitable, for lack of concealment and for other reasons, and he was ordered to find a new one. In selecting a B. C. station he chose one from which he could not see all the target, when a short move would have given full view of it. Deflection difference was about seven mils too great, and deflection determined badly erroneous. Firing data transmitted confusedly, and erroneous corrections given. The officer sensed every shot, some of them clearly doubtful. He thought at first he had a bracket at 2500-2600, and later that it was 2700-2800; correct bracket was 2600-2700. It seems to be almost invariably the case that if an officer is confident that he has an over or a short a verifying shot at the same range is sensed the same whether correct or not. This case proved an exception, for a first shot at 2600 was incorrectly sensed, a second correctly. This officer changed his deflection correctly,—by bracketing instead of creeping.

The second officer reannounced his aiming point in changing target, which was unnecessary. He corrected deflection by creeping, and failed to get a bracket by erroneous observation.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
	R pi adj pi, A.P., D.4545—9, A.S. 300, Shell, Change D to 4445		2600		
4	As you were R	1	2400	—	— 190
4	Subt. 40	2	2800	+	+ 135
4	Add 2	3	2600	+	— 60
4		4	2500	—	— 85
4	Add 1	5	2550	—	— 95
4	*	6	2600	—	— 38
4	R 2700, Subt. 1	7	2700	—	+ 60
4		8	2900	+	+ 210
4		9	2800	+	+ 105
4	All the guns, by battery fr. r. 2, R 2725	10	2750	+	+ 145
3	7 not 2. Report D of each gun—Should be	11	2750	+	+ 145
2	No. 1 = 4507, 4503 = 3, No. 2 = 4505, 4501 = 4	12	2750	+	+ 70
		13	2750	+	+ 70
1	Bracket split by order of Instr.				
	No. 2.				
4	R pi adj pi., A.P., Subt. 70	14	2800	?	— 45
4	Subt. 10	15	2800	—	— 75
4	Add 3	16	3200	—	+ 290
4		17	3600	?	+ 460
4		18	3600	?	+ 500+
4	Add 3	19	3600	?	+ 500+
4	**	20	3600	+	+ 500+
4		21	2800	?	— 70
4	Subt. 2	22	2800	—	— 100
4		23	3200	—	+ 280
4		24	3400	?	+ 445
4	Add 3	25	3400	—	+ 445
4		26	3500	?	+ 500+
4		27	3500	—	+ 500+
	No. 3.				
	R pi directing pi., batt'y attn. Add 80 — 5,				
4	A.S. 300, Shell	28	3000	?	+ 240
4	Subt. 6	29	3000	?	+ 240
4	Subt. 2	30	3000	—	+ 285
4		31	3400	+	+ 500+
4		32	3200	?	+ 430
4		33	3200	?	+ 465
4	Subt. 1	34	3200	?	+ 380
4		35	3200	—	+ 390
4	***	36	3300	+	+ 460
4		37	3200	+	+ 400
4		38	3100	?	+ 285
4		39	3100	—	+ 285
4		40	3200	—	+ 380

* Ordered by Instr. to verify long R. of bracket.
** By order Instr. verify 2800.
*** Order Instr. verify 3200.

The third officer gave commands improperly and announced superfluous data for change of target. He once sensed 3200 correctly after having sensed it erroneously, went back to it and again sensed it incorrectly. Failed to get bracket through bad observation.

In general the problems brought out the following:—that smoke of detonation of H. E. shell is of nearly the same color as battery shields; that a large percentage of erroneously observed shots are overs; that in time fire a long bracket with a walk-through will

usually have to suffice; that with shell it will often be necessary to use a bracket and walk-through, and that it will usually be impossible to come down to a single range. Verifying salvo is not usually justified by results; the French regulations provide that the officer *may* verify if he has reason to doubt, but not that he *shall* verify. Corrections in deflection and height should be made by bracketing, as in case of range. In the firing of the second officer it was noted that his changes back and forth in deflection were coincident with considerable changes in range; indicating that he was being deceived by variations in range into believing that he was getting variations in distribution. Long ranges should be particularly watched as liable to create this erroneous impression. The known lateral dispersion of shots should prevent an officer from making changes of one mil in deflection from observation of one shot.

TWENTY-SIXTH EXERCISE.

Field work,—panoramic sketching and simulated firing. In the latter, two batteries fired upon a single target, to bring out various expedients that may be used in ranging, to insure identification by each battery commander of his own shots. Among those proposed were the following:—to identify first shots use high corrector, or take such deflection as to throw shots well to right or left; for general ranging let each battery take a particular part of the target, having a permanent rule in the battalion,—as for instance, that the right battery has the right end of the target; or, let each battery commander wait for the report of the guns of the battery firing next before him, and then give his own commands for firing,—each battery commander thus gets a chance to see his own shots, but, on the other hand, a delay in one battery delays the whole battalion.

The lecture room session was devoted to a discussion of the morning's field work.

TWENTY-SEVENTH EXERCISE.

Field work,—panoramic sketching, and actual firing. (Practice Report No. 3.)

School Practice No. 3.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. March 26, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2400	German battery, 6 guns, 6 caissons, observing caisson & ladder.	54	0	0	14 N. B.	0	8′ (6′ 50″)
2	2400	Trench.	9	0	0	8 N. B.	0	4′ 30″ (4′ 30″)
3	2400	German battery, 6 guns, 6 caissons, & observing caisson.	54	0	0	9 N. B.	0	5′ 10″ (3′ 15″)
4	2400	German battery, 6 guns, 6 caissons, observing caisson & ladder.	54	0	0	10 N. B.	0	6′ 20″ (6′ 20″)

Shell, Nitro Cellulose Powder, Picatinny Arsenal, Lot 1, 1908, 3″ Field Guns, Models 1902, 1904 and 1905. Charge 24⅞ ozs. M. V. 1640 F. S. Pressure 27300 pounds, 110 grain percussion primer and ¼ oz. igniter.

Critique.—First officer.—Some confusion in giving first commands. Fired at 3200, and shot was lost, but properly regarded as over because of obvious form of ground. Officer later improperly returned to 3200, and, failing to observe shot, went to 3600. After verifying 2900, which he had previously sensed incorrectly, he sensed 2800 incorrectly and failed to get a 100-yard bracket as required by the problem. One erroneous change in deflection ("subtract 5"), and too frequent slight changes in deflection, overlooking probable lateral dispersion.

Second officer sensed 2600 incorrectly, and so failed to get 100-yard bracket.

Third officer correctly assumed lost shot at 3000 as over, on account of form of ground, but sensed 2800 incorrectly and so failed to get 100-yard bracket.

Fourth officer made too great an error in deflection in changing target, and made too frequent small deflection changes. Sensed 2800 and 3000 incorrectly, and failed to get 100-yard bracket. Change of deflection "add 8" was entirely unwarranted.

Time was good, except in case of first officer.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
1	A.P., D., L pi adj pi., D.3675—1, Shell, A.S. 300	1	3200	Lost	+ 650
1		2	2800	?	+ 150
1	Subt. 3	3	2800	—	+ 150
1	Add 2	4	3200	Lost	+ 550
	Not fired		3600	*	
1	*	5	3200	Lost	+ 555
1		6	3000	?	+ 355
1	Subt. 5	7	3000	Lost	+ 425
1		8	3000	? right	+ 390
1	Add 10	9	3000	? right	+ 320
1	Add 5	10	3000	+	+ 365
1	Add 1	11	2900	—	+ 220
1	**	12	2900	+	+ 175
1	***	13	2800	? left	+ 110
1	Subt. 2	14	2800	—	+ 110
	No. 2.				
1	Subt. 70	15	3000	+	+ 430
1		16	2600	?	— 50
1	Subt. 10	17	2600	?	— 65
1		18	2600	+	— 35
1		19	2200	—	— 600
1		20	2400	—	— 310
1		21	2500	—	— 145
1		22	2600	Target	— 45
	No. 3.				
1	Subt. 50	23	3000	Lost	+ 375
1		24	2600	—	— 230
1		25	2800	?	+ 15
1	Subt. 10	26	2800	?	+ 110
1		27	2800	—	+ 80
1		28	2900	+	+ 270
1	****	29	2800	Lost	+ 100
1		30	2800	?	+ 160
1		31	2800	—	+ 85
	No. 4.				
1	Add 170	32	2400	?	— 325
1	Subt. 40	33	2400	—	— 260
1	Add 2	34	2800	?	+ 160
1	Add 8	35	2800	—	+ 90
1		36	3200	? lost	+ 545
1		37	3200	? lost	+ 555
1		38	3000	?	+ 350
	Add 2	39	3000	—	+ 355
1	Add 2 (Not fired)		3100		
1	*****	40	3000	—	+ 335
1		41	3100	+	+ 445

* Ordered by Instr., verify 3200.
** Ordered by Instr., verify 2900.
*** Ordered by Instr., verify 2800.
**** Ordered by Instr., verify 2800.
***** Ordered by Instr., verify 3000.

TWENTY-EIGHTH EXERCISE.

Field work, tactical exercise. "Blue" artillery represented by a battalion, and "Red" artillery, machine guns and infantry by targets; the targets were manned, and fire simulated by flashes. Occupation of position was the principal feature. At the critique

it appeared that, although due care had apparently been exercised, the occupation of position had been observed by the enemy; that in most exercises, as in this case, the limbers are not placed far enough to the rear, and not sufficiently covered; that there is a tendency for the artillery commander to start off to carry out his orders without having taken time for full consideration; that battery and battalion stations are often selected with too little consideration of concealment. Point was made of the value of supporting infantry by fire, rather than by changing position and going forward with the infantry, unless the latter plan is absolutely necessary.

TWENTY-NINTH EXERCISE.

Field work,—panoramic sketching, and actual firing (Practice Report No. 4).

School Practice No. 4.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma. March 28, 1912.

Conditions of observation: (Rainy) Good. Difficult during second problem.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2500	U. S. battery, 4 guns, 6 caissons, 1 observing ladder.	36	0	0	10	0	7′
2	2500	U. S. battery, 4 guns, 4 caissons.	30	0	0	16	0	10′
3	2500	U. S. battery, 4 guns, 6 caissons, 1 observing ladder.	36	0	0	5	4	11′ 20″ (2′ 10″)
4	2500	U. S. battery, 4 guns, 4 caissons.	39	0	0	6	4	5′ (4′)

Shrapnel: Nitro Cellulose Powder, Picatinny Arsenal, Lot 1, 1908, 3″ Field Guns, Models 1902, 1904 and 1905. Charge 20 1-6 ozs. M. V. 1700 F. S., Pressure 30000 pounds. 110 grain percussion primer and ¼ oz. igniter.

Fuze F. A. 21 sec. comb. Model 1907. Lots 112 & 113, 1910.

Critique.—First officer.—Angle of site about 12 points too high. Lost shot at 2400 correctly taken as over, on account of form of ground. Failed to sense shots at 2200, and properly tried 2100 and 2300, which were correctly sensed; then returned to 2200

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
4	L. pi adj pi., A.P., D.4990 + 2, A. S. 309, percussion shrapnel	1	2400	Lost	+ 234
4		2	2000	—	— 198
4		3	2200	?	— 30
4	Add 2	4	2200	?	+ 23
4		5	2100	—	— 60
4		6	2300	+	+ 114
4		7	2200	+	+ 2
4		8	2100	?	— 54
4		9	2100	—	— 129
4		10	2200	+	+ 69
	No. 2.				
3	Battery attn., L pi adj pi., Add 90, change adj pi., 3rd pi adj pi., Add 90	11	2200	Not fired.	
3	Add 20	12	2200	?	— 25
3		13	2200	?	— 22
3	Add 2	14	2200	?	— 30
3		15	2200	?	— 40
3		16	2200	?	Target.
3	Add 3	17	2200	+	— 2
3		18	1800	—	— 16
3		19	2000	—	— 252
3	Add 1	20	1900	—	— 138
3		21	2100	?	— 185
3		22	2100	?	— 98
3	Add 3 *	23	2100	—	— 117
3		24	2200	?	— 99
3		25	2200	—	— 88
3		26	2600	+	— 60
					+ 360
	No. 3.				
2	Change target, A.P. the same, 2nd pi adj pi. Subt 110, A.S. 296	27	2400	—	— 126
2	Add 7	28	2800	+	+ 207
2		29	2600	+	+ 29
2		30	2500	—	— 58
2	P 2550, As you were. **	31	2600	+	+ 101
1	By battery from right, Subt. 15	32	2500	—	— 58
2		33	"	—	— 26
3		34	"	?	+ 48
4		35	"	?	+ 318
	No. 4.				
1	Battery attention. R pi adj pi., A.S. 300, Add 120	36	2200	?	+ 200
1	Add 5	37	2200	—	+ 210
1		38	2600	+	+ 39
1		39	2400	—	— 130
1		40	2500	+	— 19
1	Add 1 ***	41	2500	—	— 48
1	By battery from right. Subt. 22	42	2500	—	— 37
2		43	"	—	— 34
3		44	"	—	+ 70
4		45	"	+	+ 42

* Ordered by Instructor, add 3.
** Ordered by Instructor, verify 2600.
*** Ordered by Instructor, verify 2500.

and got correct sense. Last three shots fired because officer's memory left him uncertain whether he had 100-yard bracket.

Second officer should probably not have fired, as he could see targets only occasionally. Estimate of range good. Range 1900 was erroneously given; officer intended 2100, but did not change to save confusion of commands. "Creeping" in change of deflection was a fault; if bold change had been made, he probably would have sensed some of the undetermined shots at 2200. Bracket not determined.

Third officer gave commands "change target" and "aiming point the same," which were superfluous. Excessive delay in giving proper commands for battery salvo. Further delay caused through fact that data had not been properly followed and set at the guns not firing.

Fourth officer gave commands in improper sequence. Bracket secured through improper sensing of erratic shots at 2200 (probably erroneous laying).

THIRTIETH EXERCISE.

Field work,—panoramic sketching and simulated fire. Regular time allowance for panoramic sketching is now five mniutes. The work in simulated fire emphasized two points:—(1) that the larger part of non-effective fire is due to firing over the target, and therefore it is important to determine short limit of bracket surely; (2) that when a *sure* bracketing salvo is observed, a drop-back of 100 yards should be made and walk-through begun at once.

Afternoon session devoted to a lecture on the work of militia field artillery, and to a demonstration of the operation of appearing and disappearing moving infantry targets.

THIRTY-FIRST EXERCISE.

Field work consisted of measurement of angle of site of ten different targets by nine different officers, each with a different instrument. Each officer measured each target with each instrument, making eighty-one readings on each target. The object of the exercise was to test variations of readings as made by different officers and with different instruments. It appeared that, even excluding readings made on one or two instruments that were in bad condition, variations were such that readings to the nearest five mils would give results little if any beyond the probable personal and mechanical error.

THIRTY-SECOND EXERCISE.

Field work,—panoramic sketching and simulated fire. Practice was given in the use of the B. C. telescope as an aiming point; attention was called to the large deflection difference required when the aiming point is very near the battery.

Lecture room session,—general discussion; the following points, among others, were brought out:—(1) the reason why the actual range of the target is too long a range for shrapnel fire is, that the dispersion due to errors of the gun is considerable at midranges, and simply raising the corrector might not shorten the range of burst sufficiently for effect; (2) if approximately equal forces of artillery were firing upon each other, with little advantage on either side, and an important infantry target should appear within range of one, the artillery should immediately fire upon it even though the final result should be to put the battery out of action; the all-important target is infantry, and upon its success or failure depends the outcome of the action.

THIRTY-THIRD EXERCISE.

Field work,—panoramic sketching and actual firing. (Practice Report No. 5.)

School Practice No. 5.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 2, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	3600	American battery, 4 guns, 5 caissons, 33 men.	33	0	0	12	0	7′ 20″ (7′ 20″)
2	3600	American battery, 4 guns, 5 caissons, 33 men.	33	0	0	10	0	4′ (2′ 15″)
3	3100	American battery, 4 guns, 5 caissons, 33 men.	33	0	0	15	0	9′ (9′)
4	3500	American battery, 4 guns, 4 caissons, 33 men.	33	0	0	12	0	7′ (7′)
5	3500	American battery, 4 guns, 4 caissons, 33 men.	33	0	0	5	0	3′ (3′)

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Models 1902, ′04, ′05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 30000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze F. A. 21sec. comb. Model of 1907. Lots 112 & 113, 1911.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
	R. gun adj pi., A.P., D.3361 — 2, Cr.295.				
4	A.S. 295 per. shrap	1	3000	—	— 355
4		2	3400	—	— 115
4	Add 5	3	3800	—	Target.
4	Subt. 3	4	4200	Lost	+ 480
4		5	4200	+	+ 300
4		6	4000	+	+ 290
4		7	4100	+	+ 170
4		8	4000	+	+ 115
4		9	4000	+	+ 152
4		10	3800	?	+ 70
4	Add 2	11	3800	?	— 30
4	Subt. 2	12	3800	?	+ 26
	No. 2.				
4		13	3800	?	+ 6
4	Add 1	14	3800	?	+ 10
4		15	3800	?	+ 2
4		16	3800	+	+ 60
4		17	3700	—	— 75
1	By battery from the right. *	18	3750	—	— 76
2		19	"	—	— 62
3		20	"	—	— 1
4		21	"	—	— 35
	No. 3.				
4	A.P., D.3250—2, A.S. 295, per shrap.	22	2400	—	— 470
4	Subt. 80	23	2800	—	— 220
4	Add 20	24	3200	Lost	— 90
4		25	2800	—	— 220
4		26	3200	+	— 130
4	Add 10	27	3000	—	— 260
4		28	3100	—	— 190
4	Add 10	29	3200	—	— 185
4		30	3600	?	+ 105
4	Subt. 5	31	3600	+	+ 90
4		32	3400	+	+ 290 *
3	2nd pi adj pi.	33	3400	?	— 10
3	Add 5	34	3400	?	— 28
3		35	3400	—	— 15
3		36	3500	—	+ 80
	No. 4.				
	R pi adj pi., D.6198+10, steady+7, A.S.				
1	310, per shrap.	37	2600	?	— 290
1	Subt. 30	38	2600	—	— 285 *
1	Add 10	39	3000	?	— 145
1	Add 6	40	3000	—	— 125
1		41	3400	+	+ 150
1		42	3200	+	Lost
1		43	3100	+	+ 260 * ?
1	**	44	3000	+	+ 265 * ?
1		45	2800	+	+ 85
1		46	2600	Lost	— 295 * ?
1		47	2600	Lost	— 295
1		48	2700	—	— 275
	No. 5.				
1	Battery attention. R pi adj pi.	49	2800	—	— 230
1	Subt. 5	50	3200	—	— 27
2	Subt. 2. 2nd pi adj pi.	51	3600	+	+ 300
2		52	3400	+	+ 170
2	Add 2	53	3300	+	+ 70

* By order; fire salvo mid range of bracket.
* Ricochet. ? Doubtful.
** Ordered by instructor, verify 3000.

Critique.—First officer gave firing data incorrectly. Conducted fire correctly to include sixth shot; on seventh, failed to take account of previous observation and wasted ammunition. Too frequent minor changes of deflection. Problem not solved; 100-yard bracket required.

Second officer already had his own observations of previous fire at same target, showing range 3800, and should have proceeded accordingly. Was ordered to determine 100-yard bracket; could have continued fire at 3800, or fired at 3700 and 3900, which would at once have given bracket with target at one end.

Third officer made large error in original change of deflection, and failed to make bold corrections. Failure to get true sense of shots due almost entirely to faulty deflection. Problem not solved. Firing of 25th shot was not warranted. The 29th was fired because 28th had fallen apparently so far short and was correctly sensed. Bracket was then begun over.

Fourth officer gave data badly. Got two different brackets for same target with same gun in same position. Having observed 3000 as short, was ordered to verify and sensed it as over; then proceeded to determine second bracket.

Fifth officer, continuing same problem, got still a third bracket under the same identical conditions. Brackets were 3000-3100, 2700-2800, 3200-3300; this explained on theory that a number of bursts were on ricochet.

THIRTY-FOURTH EXERCISE.

Field work similar to that in twenty-eighth exercise. Good opportunity afforded for employment of scouts and agents. Conduct criticized principally because of failure to get scouts well out to the front promptly, and keep them there; delay in establishing telephone communication; failure of agents of communication to be in proper places; failure to make sufficient reconnaissance of position.

THIRTY-FIFTH EXERCISE.

Field work,—panoramic sketching, and actual firing. (Practice Report No. 6.)

School Practice No. 6.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 4, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2500	Infantry skirmish line.	84	5	10 E. 3 NE.	12	0	3′ 30″ (3′ 30″)
2	2500	Machine gun battery, 4 guns,	24	2	2	6	0	3′ 30″ (3′ 30″)
3	4500	American battery, 4 guns, 6 caissons, & 1 observing caisson.	40	0	0	14	0	6′ 40″ (6′ 40″)
4	4500	American battery, 4 guns, 6 caissons, & 1 observing caisson.	40	0	0	6 N. B. Verifying 6	0	6′* (6′)

* Verifying shots not included.

Shrapnel; Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns, Models 1902, ′04, ′05. Charge 26 1/6 ozs. M. V. 1700 F. S., Pressure 30,000 lbs. 110 grain percussion primer and ¼oz igniter.

Shell; Nitro Cellul se Powder, Picatinny Arsenal. Lot 1-1908. 3″ Field Guns, Models 1902, ′04, ′05. Charge 24⅞ ozs. M. V. 1640 F. S. Pressure 27300 lbs. 110 grain percussion primer and ¼ oz. igniter

Critique.—First officer.—Against infantry should have begun walk-through as soon as 200-yard bracket determined. Even for 100-yard bracket, seventh, eighth, eleventh and twelfth shots were superfluous. Change of corrector from 23 to 25 was rather small.

Second officer made accurate shift of sheaf in changing target. Knew range and corrector from firing on previous target; fired with too low corrector. Should not have fired fifteenth and sixteenth shots. Took too much risk in trying to get bracket by change of only 100 yards; this shown by range party's observations,—"T" and "-16."

Third officer, with first shot, got graze 5 mils below target, and should have raised corrector 10 mils. All his firing up to last four shots was with too low corrector. With proper changes, two salvos at 4200 would probably have been saved. In changing target he properly made bold deflection changes, and then brought sheaf on the most visible part of the target. Problem regarded as not solved, as officer used too much ammunition under the conditions, and did not make use of available machinery of fire to render his shots more observable. Change of range of only 100 yards, while here successful, was bad practice.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
	Battery attention, R pl adj pl., A.P., by pl from right.				
1	D.2700 — 2, A.S. 300, Cr. 28	1	2600	+ low	+ 5 g
2		2	"	+ g	+ 55 4
1		3	2200	? high	— 220 8
2		4	"	— low	— 248 7
1	Sub. 10	5	2400	— low	— 121 8
2		6	"	— low	— 121 8
1	Cr. 23	7	2400	— g	— 22 g
2		8	"	— g	— 22 g
1	Cr. 25	9	2500	+ g	— 11 g
2		10	"	T g	T g
1	Cr. 27	11	2500	T low	— 3 3
2		12	"	— low	T 4
	No. 2.				
1	Battery attention, R pl adj pl, by pl from	13	2400	+ g	+ 20 g
2	right. Add 85 Cr. 23	14	"	? normal	+ 56 5
1		15	2400	+ g	+ 80 g
2		16	"	+ below g	+ 120 g
1		17	2300	— g	— 16 g
2		18	"	? a	T 3
	No. 3.				
1	Add 220. Cr. 23	19	3400	— low	— 825 g
2		20	"	lost	— 750 g
1		21	3800	— "	— 450 g
2		22	"	— g	— 450 g
1		23	4200	? g	— 75 g
2		24	"	? g	— 30 g
1	Subt. 20	25	4200	? g	T g
2		26	"	? g	+ 4 g
1	Cr. 27	27	4200	? g	T g
2		28	"	? g	+ 60 g
1	Cr. 32	29	4200	? g	— 1 g
2		30	"	— low	T 4
1		31	4300	+ low	+ 75 6
2		32	"	— low	+ 105 12
	No. 4.				
1	Battery attention, R pi adj pi, Shell	33	4200	lost	— 90
1		34	4200	—	T
1		35	4600	—	+ 495
1		36	5000	+	+ 825
1		37	4800	+	+ 630
1		38	4700	+	+ 570
1		39	4600*	?	+ 450
1	Add 10	40	4600	—	+ 405
1		41	4200*	—	— 60
1	Add 5*	42	4200*	—	— 30
1		43	4400	?	+ 180
1	Subt. 2*	44	4400	?	+ 195

* By order of Instr.

Fourth officer, firing H. E. shell (black smoke against dark targets) failed to determine 100-yard bracket by reason of incorrect observation.

The two last problems were of interest as furnishing comparison between shell and shrapnel. Contrary to expectation, the results were practically the same, as shown by range party observations.

Ammunition recently issued has shown considerable variation in ranges between the two types.

THIRTY-SIXTH EXERCISE.

Panoramic sketching and simulated firing. Exercise in firing was conducted with a view to illustrating precautions to be taken to clear a mask. Battery was placed where it was necessary to fire over trees 25 feet high. It was pointed out that in selecting position a battery commander should, if possible, see that his guns will clear the mask at a range considerably less than that at which he is to open fire. Familiarity with the angles of departure for ordinary ranges greatly assists in quickly estimating whether a position allows sufficient leeway for probable requirements. Another point brought out was, that changing range is of little use, when using time fire, in trying to observe shots at ranges where previous shots have been lost; corrector or angle of site should be raised instead. In shell fire the change of range is the only possible expedient, and must be used.

THIRTY-EIGHTH EXERCISE.

Field work,—panoramic sketching and actual firing. (Practice Report No. 7.)

School Practice No. 7.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 9, 1919.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	3200	American battery.	55	8	14	16	0	8′ (8′)
2	2400	93 Infantry silhouettes, lying. 150 yds. × 40 yds.	93	6	5	10	0	4′ 35″ (4′ 35″)
3	2400 to 2000	Moving caisson. (walk)	5 (3)	0	0	12	0	3′ 25″ (3′ 25″)
4	3000	4 Machine guns,	20	0	0	14	0	4′ 21″ (4′ 21″)

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1. 1908, 3″ Field Guns. Models of 1902, ′04, ′05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 30000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze F. A. 21 sec. comb. Model 1907. Lot 90—1910.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No 1.				
1	R pl adj pl. A.P. By pl fr r. D.2936 — 2	1	3200	— high	— 140 3
2	A.S. 304. Cr 28	2	"	— high	— 150 3
1	Add 30. Cr. 25	3	3600	+ g	+ 300 g
2		4	"	+ g	+ 280 g
1	Cr. 28	5	3400	? normal	Target 5
2		6	"	? "	+ 50 3
1	Add 7	7	3400	+ g	+ 60 g
2		8	"	lost	+ 45 g
1	Cr. 30	9	3300	? high	— 75 6
2		10	"	— normal	— 30 g
1		11	3400	? high	+ 25 5
2		12	"	? "	— 40 5
1	Cr. 28	13	3400	? "	+ 20 5
2		14	"	? "	— 45 5
1	Cr. 25	15	"	+ g	+ 150 g
2		16	"	+ below	+ 70 g
	No. 2.				
1	Subt. 300, Cr. 27	17	3000	? normal	+ 450 3
2		18	"	? "	+ 450 3
1	Add 40, Cr. 25	19	3000	? "	+ 450 5
2		20	"	+ low	+ 450 3
1	Subt. 20	21	2600	? normal	+ 240 4
2		22	"	+ low	+ 235 4
1	Cr. 23	23	2200	? normal	— 75 g
2		24	"	— low	— 90 3
1	Add 5 + 3	25	2400	? normal	+ 90 4
2		26	"	+ 0	+ 90 g
	No. 3.				
1	T. V. F. 1 rd. Cr. 25, R pl only	27	2000	—	— 280 4
2		28	"	—	— 240 8
1	Chf. Pis. watch D.	29	2600	—	+ 360 4
2		30	"	—	+ 400 12
1	Cr. 23. Watch Cr.	31	3000	—	+ 500 + 16
2		32	"	—	+ 500 + 24
1	Cr. 20	33	3600	+	+ 500 + 30
2		34	"	+	+ 500 + 30
1	Cr. 23	35	3400	+	+ 500 + g
2		36	"	+	+ 500 + 30
1	Cr. 25	37	3000	?	+ 500 + 4
2		38	"	?	lost
	No. 4.				
1	T. R pl adj pl. A.P. by pl fr r. D.290 + 5	39	2800	— low	— 100 2
2	A.S. 300, Cr. 25	40	"	— "	— 130 4
1	Add 20	41	3200	? g	+ 280 g
2		42	"	+ g	+ 240 * g
1	Subt. 5.	43	3000	? normal	— 16 10
2		44	"	? g	— 60 g
1		45	3000	— low	+ 80 4
2		46	"	? g	+ 70 g
1		47	3100	? g	+ 200 g
2		48	"	? g	+ 190 g
1	Cr. 27	49	3100	? low	+ 150 2
2		50	"	? "	+ 100 4
1	Subt. 3	51	3100	+ g	+ 180 g
2		52	"	? low	+ 150 2

* No burst.

Critique.—While first officer determined bracket 3300-3400 he did not remember it, and reported his bracket as 3200-3400 when ordered to cease firing. Corrector did not respond consistently

to changes made. All shots after tenth were unnecessary. Problems regarded as unsolved because of failure to announce correct bracket.

Second officer should have lowered his angle of site a trifle. Followed correct system, of making bold deflection corrections. Announced bracket as 2400-2600 instead of 2200-2400, as actually determined, and problem therefore regarded as unsolved.

Third officer should have obtained at least 200-yard bracket, at so slowly moving target. Sensed shots incorrectly; some were so high that observation could not possibly have been reliable. Made a variety of range changes that was entirely unwarranted. Gave firing data and directions to chiefs of platoon incorrectly. Variations in burst indicated that fuze setters were not properly operated. Problem not solved.

Fourth officer began with idea of using direct fire, then changed to indirect because target could not be seen by gunners. Corrector somewhat erratic. Announced bracket as 3000-3100; as this depended upon erroneous observation of 45th shot, it was regarded as incorrect, and problem not solved. A 200-yard bracket would have been sufficient, as target was machine guns.

THIRTY-NINTH EXERCISE.

Similar to twenty-eighth. Use of reconnaissance officers and scouts was illustrated; also methods of securing, transmitting, and recording information, making panoramic sketches, and reconnaissance of position.

FORTIETH EXERCISE.

Field work,—panoramic sketching and actual firing. (Practice Report No. 8.)

School Practice No. 8.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 11, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2900	Inf. irregular line. Figures, Prone.	99	10	18	10	0	5′ (5′)

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
2	2400 to 2200	Moving target, Artillery carriage.	5 (3)	1 (2)	3	6	0	2′ 40″ (2′ 40″)
3	2700	Machine gun battery, 4 guns.	26	3 (1 gun)	4	12	0	4′ 40″ (4′ 40″)
4	3000	American battery, 5 Sections.	40	3 12 on shield.	15	12	0	4′ 10″ (4′ 10″)

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Models of 1902, ′04, ′05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 3000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze: F. A. Comb. 21 sec. Model 1907. Lot 90—1910.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
4	L. pl adj pl., by pl fron L., A.P., D.3100 — 4	1	2600	? high	— 275 8
3	A.S. 300, Cr. 28	2	"	? high	— 275 8
4	Cr. 24	3	2600	? high	— 225 8
3		4	"	? high	— 180 4
4	Cr. 20	5	2600	— low	— 140 1
3		6	"	— low	— 140 g
4		7	3000	+ low	+ 150 3
3		8	"	+ low	+ 140 5
4	Change DD — 1, steady + 1, As you were, 3rd pi, add 2	9	2800	? high	+ 15 g
3		10	"	— low	— 30 3
	No. 2.				
4	R pl adj pl., by pl from R. Moving target R	11	2000	— low	— 200 g
3	to L. D.10, Cr. 23	12	"	? normal	— 200 5
4	Change deflection	13	2400	? normal	+ 200 5
3		14	"	+ normal	+ 200 5
4	*		2200		
3		15	"	— high	— 250 10
4	*		2300		
3		16	"	+ low	+ 220 2
	No. 3.				
3	Batt'y attention. R pl adj pl, by pl., steady A.P., by pl from L. D.3510 — 3, A.S.301,	17	3000	? high	+ 200 10
4	Cr. 20	18	"	? high	+ 200 10
3	Subt. 50, Cr. 15	19	3000	? normal	+ 200 6
4		20	"	? low	+ 200 4
3	Cr. 10	21	3000	? g	+ 200 g
4		22	"	+ g	+ 200 g
3	Cr. 13	23	2600	? normal	— 100 2
4		24	"	+ low	— 100 1
3		25	2200	— normal	— 200 5
4		26	"	— normal	— 200 2
3	Cr. 12	27	2400	+ low	— 50 g
4		28	"	? high	— 200 5
	All the guns, V.F.1 rd. Subt. 8, Cr. 15		2100	Cease firing.	**

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 4.				
3	Battery attention. Sub. 100, A.S. 290, R				
4	2600. As you were, Cr. 25, Rt. pl. adj.	29	2600	? normal	— 600 2
	by pl. fr. left	30	"	? normal	— 550 4
3	Subt. 100	31	2600	— low	— 500 R
4		32	"	— low	— 500 1
3		33	3000	— g	— 100 g
4		34	"	— g	— 50 g
3		35	3400	+ low	+ 300 g
4		36	"	? normal	+ 250 3
3		37	3200	? normal	+ 40 3
4		38	"	+ low	+ 70 2
3		39	3100	+ low	— 10 g
4		40	"	+ low	— 5 g
	All the guns, V.F.1 rd		2900	Cease firing.	

* Did not fire.

** Observation of range party of questionable accuracy due to their location.

Critique.—First officer.—Height of burst did not respond sufficiently to first change of corrector. Officer used left platoon to adjust, and became confused when he desired to adjust distribution,—an illustration of the disadvantage of not having the directing gun in the adjusting platoon. Firing data not in proper sequence.

Second officer.—Firing data not in proper sequence. Should have adjusted by volleys, although regulations permit adjustment as executed; advantage of volleys is that gunner gives command for firing. Target was moving at trot; walk-through should have been begun at once after getting 400-yard bracket.

Third officer.—Angle of site about 10 mils too great. Large error in original deflection. Observation of range party for 27th and 28th shots probably incorrect, on account of bad position for observation; all officers at firing point took 2400 as clearly over. Officer regarded as having 200-yard bracket.

Fourth officer gave firing data in improper sequence. Made 100 mils error in deflection on change of target. Although observation of 39th and 40th shots was erroneous, walk-through would have brought target under effective fire, and problem regarded as solved.

FORTY-FIRST EXERCISE.

Sub-caliber firing against reduced targets. All targets are miniatures of service targets, and the whole system,—targets, ranges, gun intervals,—reduced to one-tenth size. Moving targets so light that they can easily be pulled by hand at the end of a rope. Effect very realistic, practice excellent.

FORTY-SECOND EXERCISE.

Field work,—panoramic sketching and actual firing. (Practice Report No. 9.)

School Practice No. 9.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 16, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket et	Fire for effect	(Time to determine bracket)
1	2500	U. S. Battery, 4 guns, 6 caissons, battery staff.	40 (0)	0 (0)	0	0	0	Did not fire.
2				0 (0)	0	18 N. B	0	7′ 35″ (7′ 35″)
3	1500 to 1200	Moving target. Inf. advancing by rushes.	9	0	0	2 N. B	0	* 2′ 37″ (2′ 37″)
4	2000	Machine gun battery, 4 sections.	20	3**	3**	8 N. B.	0	3′ 55″ (3′ 55″)
5						10	0	3′ 17″ (3′ 17″)
6	1600	Line of infantry prone.	30	0	0	8	0	4′ 12″ (4′ 12″)

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 30000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb. Model 1907. Lot 90-1910.
* From first salvo to cease firing.
** Nos. 4 and 5 fired on same target. Unknown which made hits.

Critique.—First officer required eight minutes to prepare data after identifying target, then had data wrong. Was "killed" and another officer called up.

Second officer should have lowered corrector after third salvo; should have lowered again before he did after giving corrector 26, and then by more than one mil. Should have considered direction of wind in observing smoke of bursts; erroneous observation of 14th shot caused failure to get bracket and so solve problem.

Third officer's firing somewhat affected by failure of target to function properly. Battery did not respond well to commands given. Target disappeared before second salvo could be fired. Gave command "subtract 10," and then changed to "deflection 6,390;" correction should have been made by chiefs of platoon. Had battery limbered to make short change of position, and lost time while target was moving; should have moved by hand.

Fourth officer.—Angle of site and corrector too high. Bad error in deflection, and changes insufficient. Should not have attempted to sense 25th and 26th shots, which were too high. Problem not solved.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
	R pl adj pl, R sec adj sec, A.P., by pl from R. Steady, as you were, by pl from L			Relieved	
	No. 2.				
2	R pl adj pl, A.P., by pl from L. D.6145+5	1	3000	? l.	+ 500 + B
1	A.S. 303, Cr. 23	2	"	Lost	+ 500 + B
2	Add 10, Cr. 28	3	3000	+ low	+ 450 3
1	----------	4	"	+ low	+ 480 4
2	----------	5	2600	? low	+ 195 5
1	----------	6	"	? low	+ 195 6
2	----------	7	2600	? N	+ 120 3
1	----------	8	"	? N	+ 165 3
2	Cr. 26	9	2600	? N	+ 225 3
1	----------	10	"	+ N	+ 270 0
2	----------	11	2200	? N	— 195 4
1	----------	12	"	— low	— 120 2
2	----------	13	2400	? N	+ 45 4
1	----------	14	"	— low	+ 30 4
2	----------	15	2500	? N	+ 105 4
1	----------	16	"	? N	+ 75 4
2	Cr. 25	17	2500	? N	+ 105 2
1	----------	18	"	+ low	+ 165 0
	All the guns, V.F. 1 rd, Cr. 27		2300	Not fired.	
	No. 3.				
3	T. L pl adj pl, D.O, Cr. 25, V.F. 1 rd, Chf.	19	2000	? N	+ 500 + 0
4	pls watch D	20	"	? N	+ 500 + 2
	Sub. 10, D.6390		2000	Not fired.	
	No. 4.				
3	R pl adj pl, by pl from L. D.2040 — 2, A.S.	21	2000	? H	— 80 16
4	300, Cr. 24	22	"	? H	— 80 16
3	Add 50	23	2000	? low	— 40 15
4	----------	24	"	? low	— 32 8
3	Add 40	25	2000	— low	— 4 10
4	----------	26	"	— low	T 8
3	Cr. 20	27	2400	+ low	+ 240 ?1
4	----------	28	"	+ low	+ 236 ?1
	Add 20		2200	Not fired.	
	No. 5.				
3	Cr. 15	29	2000	? N	+ 160 ?g
4	----------	30	"	+ low	+ 120 ?g
3	----------	31	1600	— low	— 220 1
4	----------	32	"	? low	— 240 1
3	----------	33	1800	? low	— 96 6
4	----------	34	"	? low	— 40 4
3	Cr. 13 (Last range ?)	35	1800	— low	— 32 5
4	----------	36	"	? low	— 20 4
3	----------	37	1900	+ low	+ 112 0
4	----------	38	"	? N	+ 60 2
	No. 6.				
3	Subt. 250, A. S. 295, Cr. 20	39	2000	+ g	+ 480 g
4	----------	40	"	+ low	+ 400 2
3	Subt. 20	41	1600	— N	— 40 8
4	----------	42	"	— low	— 24 8
3	----------	43	1800	+ N	+ 160 4
4	----------	44	"	+ N	+ 144 4
3	----------	45	1700	? N	+ 24 5
4	----------	46	"	+ N	+ 24 3

Fifth officer properly reduced corrector and again reduced when he found shots too high. Forgot one range and had to consult record. Attempt to get 100-yard bracket against machine guns unnecessary; 200-yard bracket would have solved problem.

Sixth officer properly reduced angle of site, which was too high, and raised corrector at same time. Fired with corrector a little high. Attempt at 100-yard bracket unnecessary against infantry.

FORTY-THIRD EXERCISE.

Field work,—panoramic sketching and simulated firing, illustrating clearing mask at shortest probable range, and quick methods of selecting position. Three methods illustrated.

1.—Take angle of departure for shortest range desired, from B. C. ruler,—e. g., 38 mils for 1,600 yards. Subtract from this an allowance for safety, say 20. "Push slide out so that it reads 18 mils clear of ruler. Move down from crest until a position is found where, measuring from a point on the slope on a level with the eye, the angle to the top of the mask is less than 18 mils. This requires practice in determining points on a level with the eye.

2.—Stand on the crest and measure with ruler 38 mils down from the distant horizon (regarded as zero angle of site). This locates the limiting position to clear crest at 1600 range.

3.—Make same measurement as in (2), but with telescope for greater accuracy.

FORTY-FOURTH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 10.)

School Practice No. 10.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Okahoma.
Conditions of observation; Excellent. April 18, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	3000 to 2500	Moving target, 1 sled, 1 sled (Ord.). Advancing cavalry trot.	8 (8) 2 (2)	0	0	0 N. B.	0	2′ (2′)
2	2200	Machine gun battery, 4 guns.	25	3* 3 on materiel.	6*	10 N. B.	0	4′ 05″ (4′ 05″)
3	4000	American battery, 4 guns & 6 caissons.	40	1 *	1 *	8 N. B.	0	3′ 20″ (3′ 20″)

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)*
4	4000	Trench, 200 yds.	6	0	0	10	0	3′ 40″ (3′ 40″)
5	4000	Same as target No. 3.	40	1 *	1 *	8	0	2′ 45″ (2′ 45″)
6	2200	Same as target No. 2.	25	3*	6*	10	0	3′ 04″ (3′ 04″)

* Total effect of 2nd & 6th problems.

* Total effect of 3rd & 5th problems.

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns, Model 1902, '04, '05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 30000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze: F. A. 21 sec. comb. Model 1907. Lot 90—1910.

Critique.—First officer.—Battery not placed high enough on slope for direct fire; one gunner could not see target at shortest range. Target was approaching battery, but problem was handled as if it had been stationary. Final limit of bracket was not in front of target. Problem not solved.

Second officer.—Firing data incorrectly given. Angle of site too great. Error in first deflection too great. Observation did not warrant lowering corrector. Deflection difference 5 mils out; should have been -9; error increased by command "increase by 2." Command for changing deflection difference given in uncertain manner. Bracket erroneously determined, and problem not solved.

Third officer.—Erroneous deflection in changing target due to failure to identify large part of target previously fired upon. Corrector should have been raised 5 mils at each change of range. Range 3400 should not have been repeated, but having been announced it was correct not to change it. After calling 24th shot officer changed his mind, and, instead of regarding it as doubtful and firing again at same range, improperly went to 4600. Bracket not determined and problem not solved.

Fourth officer.—Burst of 30th shot erratic. Command "as you were" should not have been given. First announced 200-yard bracket, which was not sufficient against a trench; fired again by order, and got 100-yard bracket.

Fifth officer.—The 41st and 42d shots were doubtful, but by good luck were correctly sensed. Made no effort to adjust corrector, and problem regarded as not solved.

No. Sec.	Commands given.	No. Rds	Range	Observation	
				At battery	Range party
	No. 1.				
1	R. pl adj pl, T.V.F. ted, Cr. 23, R, C F.D. 0	1	3000	— g	— 26 g
2	C.F.	2	"	? g	+ 39 g
1	Cr. 28	3	3400	+ g	+ 500 + g
2		4	"	+ L	Lost
1		5	3200	+ g	+ 350 g
2		6	"	+ g	+ 375 g
	Cr. 33		3100	Not fired.	
	No. 2.				
2	R pl adj pl, A.P. by pl from L. D.2705—4	7	2400	? g	+ 195 10
1	Cr. 23, R. Cr. 23 "ou've got, A.S. 300	8	"	? g	+ 172 10
2	Subt 80	9	2400	? low	+ 82 6
1		10	"	T g	+ 30 g
2		11	2400	+ g	+ 112 g
1		12	"	+ low	+ 111 g
2	Cr. 21	13	2000	— g	— 247 3
1		14	"	— g	— 277 0
2	Inc. by 2, steady, as you were, Inc by 2	15	2200	+ g	— 52 3
1		16	"	— g	— 90 1
	No. 3.				
2	Batt'y attention, Subt. 20, A.S. 302. Cr. 20	17	3400	? g	— 500 + g
1		18	"	— low	— 500 + g
2	dd 30, Cr. 25	19	3400	— g	— 500 + g
1		20	"	— g	— 500 + g
2	Cr. 28	21	3800	— g	— 180 g
1		22	"	— g	— 170 g
2	Cr. 32	23	4200	? B	+ 135 - 1
1		24	"	+ B *	+ 120 - 2
	Cr. 36		4600	Not fired.	
	No. 4.				
2	Batt'y attention, Add 30	25	4000	? high	+ 20 21
1		26	"	? low	+ 91 g
2	Cr. 32	27	4000	— low	+ 119 2
1		28	"	? g	+ 40 g
2		29	3600	— g	— 280 g
1		30	"	Lost	— 280 231
2		31	3800	— N	— 140 20
1		32	"	— g	— 60 g
2	R, C.F., As you were. C.F.	33	3900	+ low	+ 56 2
1		34	"	? g	— 20 g
	No. 5.				
2	Batt'y attention, R pl adj pl, Subt, 40, A.S. 302, Cr. 30	35	3400	— low	— 500 + 0
1		36	"	— g	— 500 + g
2	Add 10	37	3800	— g	— 200 g
1		38	"	— g	— 245 g
2		39	4200	+ g	+ 94 g
1		40	"	+ g	+ 124 g
2	Subt. 5	41	4000	— g	— 40 g
1		42	"	— g	— 32 g
	No. 6.				
2	Batt'y attention, Add 10, Cr. 30	43	2000	— g	Lost
1		44	"	? high	— 135 20
2		45	2400	? high	+ 45 12
1		46	"	? high	+ 45 10
2	Subt. 10, Cr. 25	47	2400	? low	+ 90 8
1		48	"	? g	+ 172 g
2	Subt. 10	49	2400	? N	+ 120 5
1		50	"	+ g	+ 75 1
2		51	2200	? N	— 75 4
1		52	"	— g	— 75 g

* Steady that isn't over.

Sixth officer.—The 43d shot burst near muzzle, but officer saw case of 44th strike and mistook it for a projectile grazing and not exploding. No change of corrector for second salvo, as first had apparently given one high and one graze. Erroneous deflection prevented sensing an over until 50th shot. Laying of first piece apparently erroneous throughout.

Deflection difference error begun in second problem continued throughout series.

FORTY-FIFTH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 11.)

School Practice No. 11.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 22, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2800	American battery, 4 guns & 6 caissons.	40	1	1	12	0	4′ 15″ (4′ 15″)
2	2800	Infantry skirmishers, 2 lines 100 yds. long, 10 yds. deep.	76	7	7	12*	0	5′ 17″ (5′ 17″)
3	3100	Intrenched Inf. 100 yds. long. 6 figures visible.	6	0	0	10	0	4′ 25″ (4′ 25″)
4	1500 2100	Moving cavalry, trot & gallop.	8 (8)	8 (3)	12	8	0	1′ 03″ (1′ 03″)
5	2000	Machine gun battery, 4 guns.	35	0	0	6	0	1′ 19″ (1′ 19″)
6	1900	Infantry trench. 60 yds. long.	0	0	0	12	0	2′ 45″ (2′ 45″)

* 8 shots to determine bracket on proper target.

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 30000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze: F. A. 21 sec. comb. Model 1907. Lot 90-1910.

Critique.—This practice, while marked by a few technical errors and a few cases of data transmitted in wrong sequence, was on the whole excellent. Two officers fired at first upon wrong targets, in one case the target indicated being the wrong one and in the other the target being wrongly identified. The officer who fired at entrenched

No. Sec.	Commands given.	No. Rds	Range	Observation At battery	Range party	
	No. 1.					
	Bt. at. R pl adj pl, A.P., by pl fr.L, D.6100 + 3, A.S. 304, Cr. 26		3000	telieved	*	
	No. 2.					
3	Bt.at., R pl adj pl. A.P, by pl fr L. D.300	1	3000	+ Low	0 + 220	g
4	+ 3, A.S. 305, Cr. 25	2	"	+ Low	L + 220	0
3		3	2600	?	g — 75	g
4		4	"	?	2 — 60	2
3	Subt. 10, Cr. 28	5	2600	?	g — 75	g
4		6	"	?	4 — 120	4
3	Subt. 5	7	2600	— g	g — 30	g
4		8	"	? g	g — 30	g
3		9	2800	+ Low	2 + 100	3
4		10	"	? N	2 + 120	4
3	Take 3 sec. intervals	11	2700	+ Low	g + 45	g
4		12	"	? N	4 T	3
	All the guns, V.F. 1 rd.+1, Cr. 30		2600	Not fired.		
	No. 3.					
3	(Add 50) Bt.at. Add 60, Cr. 26, R pl adj pl.	13	2600	? g	1 + 40	g
4	by pl fr L	14	"	? N	3 — 25	3
3	Subt. 20	15	2600	? g	g + 40	g
4	**	16	"	— g	g + 80	g
3	Cr. 30, Add 300, Cr. 30	17	2600	? High	4 — 220	10
4		18	"	? "	5 — 200	14
3	Cr. 28, Subt. 50, Cr. 28	19	2600	— Low	2 — 70	6
4		20	"	? "	4 — 80	9
3		21	3000	+ "	B? + 290	2
4		22	"	? High	6 + 240	12
3		23	2800	+ Low	1 + 120	1
4		24	"	+ "	1 + 140	3
	No. 4.					
3	Subt. 200	25	3000	? Low	L — 160	7
4		26	"	? "	L — 270	7
3	Subt. 100	27	3000	— "	g T?	g
4		28	"	— Low	° T?	1
3	Subt. 20	29	3400	+ "	0 T?	1
4		30	"	? Lost	0 + 300	4
3	Add 10	31	3200	+ Low	1 + 150	0
4		32	"	+ N	2 + 180	6
3	Add 5	33	3100	? g	g + 45	g
4		34	"	+ Low	0 + 45	g
	All the guns, V.F. 1 rd, Cr. 30		2900	Not fired.		
	No. 5.					
3	T. R pl adj pl by pl fr L. V.F. 1 rd. Cr. 25.	35	1400	— Low	B? — 340	g
4		36	"	— "	2 — 280	4
3		37	1800	+ "	6 + 150	3
4		38	"	+ "	3 + 90	5
3		39	1700	— "	4 — 185	6
4		40	"	— "	5 — 60	10
3		41	2000	+ "	B? + 135	0
4		42	"	+ "	L + 225	0
	All the guns, V.F. 1 rd		2000	Not fired.		
	No. 6.					
3	R pl adj pl. A.P. by pl fr L. D.6210+3	43	2200	+ g	1 + 180	0
4	A.S. 300. Cr. 28	44	"	+ g	1 + 280	0
3	Subt. 15, Cr. 30	45	1800	— Low	3 — 270	5
4		46	"	— N	4 — 270	5
3	Subt. 10	47	2000	— Low	2 T	1
4		48	"	— N	3 — 80	3

No. Sec.	Commands given.	No. Rds	Range	Observation: At battery		Observation: Range party
	No. 7.					
3	Bt. at. R pl adj pl, A.P. by pl fr. L	49	2400	? N	3	+ 400 3
4	D 250 + 3, A.S. 304, Cr. 28	50	"	? N	5	+ 385 3
3	Subt. 20, Cr. 26	51	2400	+ Low	3	+ 440 6
4		52	"	+ "	2	+ 430 4
3		53	2000	+ "	g	+ 80 0
4		54	"	? "	2	+ 80 1
3		55	1600	— "	0	— 480 3
4		56	"	? "	0	— 430 5
3	Subt. 20	57	1800	— g	0	— 140 2
4		58	"	— N	2	— 130 3
3		59	1900	— Low	3	— 60 4
4		60	"	— "	3	— 50 4
	All the guns, Cr. 28		1800	Not fired		

* Height of burst at firing point in mils.
** First 2 salvos, shots 13-16, fired at wrong target. Error made in indicating target.

infantry could see, when he got on the proper target, only one standing figure, and successfully bracketed it at 3000-3100. The officer who fired upon machine guns really sensed his first two shots as "º height of burst" rather than "graze" as he reported; this is shown by his change of corrector. The first officer called upon to fire applied his deflection, obtained with ruler, in the wrong quadrant, and was relieved.

FORTY-SIXTH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 12.)

School Practice No. 12.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 24, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	3500	Infantry skirmish line. 10 yds. deep, 60 yds. long.	49	8	8	14	0	6′ 47″
								(6′ 47″) **
2	4500	American battery, 4 gun sections & 1 flank caisson.	31	*	*	19	0	10′ 7″ (10′ 7″) **
3	4500	American battery,	32			10	0	6′ 1″** (6′ 1″)
4*	4000	4 gun sections & observing group.		1	1	14	0	4′ 48″ (4′ 48″)

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
5	4500	Infantry in 5 gunpits.	6	0	0	14	0	4′ 59″ (4′ 59″)
6	1500 to 1100	Moving target, cavalry slow gallop.	8 (8)	7 (7)	33 1 case hit.	8	0	1′ (1′)
7	1600	4 Machine guns.	22	0	0	6	0	1′ 35″ (1′ 35″)
8	1800	Same as No. 2.	31	*	*	10	0	1′ 45″ (1′ 45″)

* 1 case hit caisson, 2nd section. 4 bullet hits & 1 case hit on figures (2nd & 8th Problems.)

** Communication by phone unsatisfactory. Data sent by megaphone.

* Only one section visible.

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Charge 26 1/6 ozs. M. V. 1700 F. S. Pressure 30000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze: F. A. comb. 21 sec., Model 1907. Lots 112 and 113, 1910.

Critique.—First officer not justified in raising corrector to 32 and 34; this caused failure of observation at 3400. Contented himself with 300-yard bracket, as he could not observe closer.

Second officer gave one false correction, but rectified it before it reached the guns. It was not necessary to raise corrector to 28 when he did. Should have stopped and investigated erratic 24th shot before continuing. Range 4200 erroneously given but changed before it reached guns. Failed to secure bracket, through faulty observation.

Third officer started with corrector too high, as he should have observed from previous firing.

Fourth officer should have lowered corrector after first salvo.

Fifth officer properly raised corrector 5 mils to get observation at range where shots lost. Might better have assumed 4800 over, from smoke in trees in rear of target, and tried shorter range instead of continuing at 4800. Final corrector should have been raised more than 2 mils above that for previous rounds.

Seventh officer sensed some shots which were too high, but correctly. From this observation, should have begun fire for effect at 1500 rather than 1700, although 1700 was actually the most effective range.

Eighth officer started with too high corrector, and did not lower it enough on first change, although change was consistent with his observations.

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	No. 1.	1	2800	— g	g	— 330 g
					Mils.	*Yds.*
2	R pl adj pl, A.P. by pl fr. L. D.3200					
1	—5, A.S. 297, Cr. 25	2	"	— g	g	— 330 g
2	Subt. 20, Cr. 30	3	3200	— g	g	— 100 g
1		4	"	? low	2	— 100 4
2		5	3600	+ g	g	+ 160 g
1		6	"	? low	2	+ 160 3
2	Add 5, inc. by 2, Cr. 32	7	3400	? g	g	+ 75 g
1		8	"	? low	1	+ 75 1
2	Cr. 34	9	3400	? low	2	+ 10 4
1		10	"	? high	6	— 10 4
2		11	3400	?	3	T 4
1		12	"	?	3	T 4
2		13	3300	— g	g	— 60 g
1		14	"	? high	5	— 50 7
	No. 2.					
2	Bt. at. Add 110, A.S. 302, Cr. 26	15	3400	— g	g	— 500 + 4
1		16	"	— low	2	— 500 + 3
2		17	3800	— g	g	— 490 g
1		18	"	— low	1	— 456 4
2		19	4200	? g	g	— 12 g
1		20	"	? g	g	— 36 g
2	Subt. 20, steady, Add 20, Cr. 28	21	4200	? g	g	— 48 g
1		22	"	? g	1	— 60 4
2	Subt. 5	23	4200	? g	g	— 48 g
1		24	"	— V. H.	L	—500+Er 120
2		25	4200	— low	g	— 42 g
1		26	"	— low	g	— 42 g
2		27	4600	Lost	L	+ 300 g
1		28	"	— V. H.	20	0 erratic 96
2	Subt. 3, R 4200 not used	29	4400	+ low	1	+ 174 g
2	R 4100, steady	30	4300	? g	g	+ 54 g
1		31	"	— V.H.	18	— 336 Er 72
2		32	4300	— g	g	+ 72 N.B.g
1		33	"	— g	g	+ 48 g
	All the guns, V.F. 1 rd		4200	Not fired.		
	No. 3.					
2	Bt. at. L pl adj pl, by pl fr r. Subt.	34	4200	— g	g	— 320 g
1	100, A.S. 305, Cr. 30	35	"	? high	6	— 448 32
3	L pl adj pl, by pl fr R	36	4600	? N	3	— 32 13
4		37	"	? high	5	— 64 19
3	Cr. 25	38	4600	+ g	g	+ 8 g
4		39	"	? g	g	+ 16 g
3	Cr. 28	40	4400	— N	3	— 288 6
4		41	"	? N	3	— 256 15
3	Subt. 5, Cr. 26	42	4500	— N	3	— 160 6
4		43	"	— low	1	— 48 g
	No. 4.					
4	R pl adj pl, A.P. by pl fr. r. D 3100.	44	3600	? N	3	— 500+4
3	Cr. 300, A.S. 300, Cr. 30	45	"	? low	1	— 500+2
4	Subt. 10	46	3600	? high	5	— 500+6
3		47	"	? high	6	— 500+6
4	Cr. 25	48	3600	— low	1	— 500+2
3		49	"	— below	g	— 500+2
4	Dim. by 5	50	4000	— g	g	— 86 g
3		51	"	? g	g	— 125 g No burst
4		52	4400	+ g	L	+ 240 g No burst
3		53	"	Lost	L	Lost
3		54	4200	+ low	1	+ 110 g
4		55	"	+ low	1	+ 80 g
3		56	4100	— low	3	— 16 5
4	Cr. 27	57	"	— low	g	— 32 N.B.
	All the guns, V.F. 1 rd		4000	Not fired.		

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	No. 5.					
4	Add 140, Cr. 30	58	4800	Lost	L	+ 150 g
3	"	59	"	Lost	L	+ 150 g
4	Cr. 35	60	4800	? N	3	+ 130 6
3	"	61	"	? N	1	+ 150 4
4	Add 40, Cr. 32	62	4800	? N	3	+ 300 5
3	"	63	"	Lost	L	Lost
4	Subt. 20	64	4800	? N	2	+ 200 ?
3	"	65	"	Lost	L	+ 200 ?
4	Cr. 31	66	4800	+ g	g	+ 300 ?
3	"	67	"	+ g	g	+ 300 g
4	"	68	4400	? g	g	T g
3	"	69	"	— g	g	— 50 g
4	"	70	4600	+ g	g	+ 100 g
3	"	71	"	? low	1	+ 100 5
	All the guns, V.F. 1 rd, Cr. 33		4300	Not fired.		
	No. 6.					
3	L pl adj pl, T. D. 0 VF. 1 rd. Cr. 25	72	1800	+	g	+ 200 0
4	"	73	"	+	1	+ 230 0
3	"	74	1400	—	3	— 40 9
4	"	75	"	—	1	+ 14 2
3	"	76	1300	—	3	— 30 9
4	"	77	"	—	3	— 30 9
3	"	78	1200	—	3	— 80 9
4	"	79	"	—	g	— 90 9
	No. 7.					
3	T. D. 0 Cr. 26	80	2000	+ low	3	+ 270 0
4	"	81	"	? low	2	+ 270 0
3	"	82	1600	— N	3	— 180 1
4	"	83	"	— N	6	— 225 5
3	"	84	1800	+ low	5	T 5
4	"	85	"	+ low	4	+ 15 5
	R. steady, All the guns, V.F. 1 rd		1700	Not fired.		
	No. 8.					
3	L pl adj pl, T. by pl fr. r. D. 0 Cr. 30	86	2400	+ N	2	+ 450 12
4	"	87	"	+ N	3	+ 360 12
3	Cr. 28	88	2000	? N	2	— 40 8
4	"	89	"	+ low	2	+—T 5
3	"	90	1600	— N	4	— 500+12
4	"	91	"	— N	5	—500+12
3	Cr. 27	92	1800	— g	3	—330 8
4	"	93	"	— low	3	—360 6
3	"	94	1900	? N	3	—180 8
4	"	95	"	— low	2	—130 6
	All the guns, V.F. 1 rd. Cr. 29		1800	Not fired.		

FORTY-SEVENTH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 13.)

School Practice No. 13.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 26, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	3300	Infantry trench.	5	1 fig. destroyed 1 direct hit on trench.		16 N. B.	0	7′ 48″ (7′ 48″)
2	2000 1500	Moving target.	8	0	0	8	0	1′ 19″ (1′ 19″)
3	3200	Infantry skirmish line.	32	0	0	8	0	2′ 46″
4	3300	Canvas battery, 4 sections.	0	2 bullet hits on caisson.	on gun. 8	12	0	4′ 06″ (4′ 06″)
5	2300	Machine gun battery.	25	*2	3	8 N. B.	0	4′ 05″ (4′ 05″)
6	3500	American battery	40	‡0	0	14 N. B.	0	5′ 10″ (5′ 10″)
7	2300	Machine gun battery.	25	*2 caisson	3 shield.	16	0	4′ 05″ (4′ 05″)
8	3200	American battery	34	†3 2 direct	4 hits on	8	2	3′ 10″ (2′ 45″)

*1 bullet hit on ammunition box, non-effective. 1 bullet hit on gun, non-effective. Same target used in Nos. 5 and 7.
‡2 bullet hits on gun shield, non-effective.
†15 bullet hits on shield, non-effective.
Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Charge 26 1-6 ozs. M. V. 1700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb., Model 1907. Lot 113, 1910.

Critique.—First officer should not have changed corrector 1 mil, 22 to 21. Forgot observation of 7th and 8th shots, and continued to fire at same range, finally sensing incorrectly and missing bracket.

Second officer's first shots should have been obviously over to him. Started with too high corrector and did not lower it. Last salvo fired after target was down. Problem regarded as unsolved.

Third officer conducted fire under the impression that his first range was 3200 instead of 3000, and reported bracket accordingly. Started to fire at 3600 but was stopped for considerations of safety.

Fourth officer gave firing data in confused and incorrect manner.

Fifth officer could not see target, and fired by order. Last salvo fired in attempt to disclose target by getting smoke behind it. On second problem failed to get bracket by incorrect observation at 3400. Change in sensing of 3800 was bad practice, but here gave

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	No. 1.					
2	R pl adj pl. A.P., by pl fr L, D.2925	1	3200	? N	4	— 110 +4
1	—2, A.S. 304, Cr. 25	2	"	? N	3	— 110 +6
2	Cr. 20	3	3200	— g	g	T g
1		4	"	— g	g	+ 2 g
2	Cr. 22	5	3600	+ B	B	+ 240 B
1		6	"	Lost	Lost	Lost
2		7	3400	+ g	B	+ 120 B
1		8	"	+ g	B	+ 180 0
2	Cr. 25	9	3400	? low	1	+ 95 +3
1		10	"	? low	1	+ 145 +3
2	Cr. 24	11	3400	? N	4	+ 120 +10
1		12	"	? low	1	+ 120 +12
2	Subt. 5, Cr. 22	13	3400	? g	g	+ 120 g
1		14	"	? N	3	+ 120 +4
2	Cr. 21	15	3400	— low	B	+ 130 B
1		16	"	? g	B	+ 180 B
	All the guns, V.F. 1 rd, Cr. 24		3300	Not fired.		
	No. 2.					
2	R pl adj pl, V.F. 1 rd, Cr. 24	17	2800	? high	6	+ 900 +8
1		18	"	? high	6	+ 900 +8
2	Add 20	19	2800	+	7	+ 1200 +8
1		20	"	+	7	+ 1200 +8
2		21	2000	+	9	+ 150 +9
1		22	"	+	11	+ 170 +9
2		23	1600	—	10	— 50 +8
1		24	"	—	12	+ 50 +8
	No. 3.					
2	Bt. at. R pl adj pl, by pl fr L, Subt	25	3000	— g	g	— 310 g
1	30, Cr. 22	26	"	— low	0	— 290 +2
			3600	Not fired.		
2		27	3400	+ B	B	+ 155 B
1		28	"	+	B	+ 204 B
2	Subt. 10, R, Cr. 24	29	3300	?	g	T g
1		30	"	?	2	+ 70 3
2		31	3300	+ g	g	+ 25 g
1	Reported bracket 3200-3400	32	"	+ g	g	+ 70 g
	All the guns, V.F. 1 rd, Cr. 27		3100	Not fired.		
	No. 4.					
1	Bt. at. R pl adj pl, Add 336, R 3200, steady by pl fr R, As you were, Add	33	3200	? high	3	— 20 +6
2	236, Cr. should be 24, Verify Cr.	34	"	— low	0	— 20 +3
1		35	3600	? high	3	+ 320 +12
2		36	"	Lost	Lost	+ 310 g
1	Add 5, Cr. 22	37	3600	+ low	0	+ 360 +5
2		38	"	+ B	B	+ 310 g
1		39	3400	+ low	B	+ 180 g
2		40	"	Lost	B	+ 200 g
1		41	3300	? g	g	+ 30 g
2		42	"	? g	g	+ 30 g
1	Cr. 24	43	3300	+ low	1	+ 60 +5
2		44	"	? N	2	T +8
	All the guns, V.F. 1 rd, Cr. 26		3100	Not fired.		
	No. 5 (1st Prob.)					
	(Could not see target)					
3	Bt. at. R pl adj pl, A.P. by pl fr L, D.5990+3, A.S., 300, Cr. 25	45	2400	? N	4	— 60 +6
4		46	"	? N	4	— 30 +6
3	Add 40, Cr. 22	47	2400	? low	1	+ 4 +2
4		48	"	? N	5	— 60 +6
3	Subt. 15	49	2400	? g	0	— 10 g
4		50	"	? low	2	— 80 +2
3		51	2800	? B	1	+ 440 +4
4		52	"	? B	1	+ 470 +4

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	(2nd Prob.)					
3	Bt. at Add 70, Cr. 22	53	3000	— B	—1	— 260 g
4		54	"	— N	0	— 280 +2
3	Subt. 20	55	3400	? low	B	+ 80 g
4		56	"	Lost	Lost	+ 140 g
3	Subt. 20	57	3400	— g	g	+ 40 g
4		58	"	— g	g	+ 120 g
3	Cr. 24	59	3800	—chg+low	1	+ 420 0
4		60	"	Lost	Lost	+ 460 +2
3		61	3600	? N	3	+ 160 +6
4		62	"	+ B	B	+ 280 0
3		63	3500	? g	B	+ 140 g
4		64	"	? N	2	+ 180 +4
3	Announced bracket 3400-3500	65	3500	+ low	0	+ 140 0
4		66	"	+ B	0	+ 200 0
	No. 6.					
3	Subt. 80	67	3200	? low	1	+ 900 +2
4		68	"	? low	2	+ 870 +2
3	Add 20, Cr. 22	69	3200	? low	0	+ 910 0
4		70	"	? low	2	+ 880 +2
3	Check up 2nd gun, 1st gun that fired	71	3200	? Lost g	g	+ 920 +2
4	Check up deflection, Cr. 21	72	"	+ low	1	+ 920 g
3		73	2800	+ low	1	+ 480 +2
4		74	"	+ low	2	+ 520 +2
3		75	2400	? g	g	T g
4		76	"	+ low	0	+ 10 +2
3		77	2000	— low	0	— 420 +2
4		78	"	— low	2	— 450 +4
3		79	2200	— low	0	— 210 +2
4		80	"	— low	2	— 220 +2
3		81	2300	? g	g	— 40 g
4		82	"	— low	2	— 80 +4
	All the guns, V.F. 1 rd, Cr. 23		2200	Not fired.		
	No. 7.					
3	Bt. at. R pl adj pl, by pl fr L, Add	83	3000	+ low	B	— 75* 0
4	220, Cr. 24, A.S. 296	84	"	? low	2	— 75 g
3	Subt. 10, Increase by 1	85	2600	— low	0	— 550 +3
4		86	"	— N	3	— 550 +5
3		87	2800	— low	3	— 300 +8
4		88	"	— N	5	— 300 +8
3	Cr. 22	89	2900	— low	g	— 75 0
4		90	"	— low	0	— 75 0
3	V.F. 1 rd (By order)	91	3000	T low	0	T 0
4	Announced bracket 2900-3000	92	"	T low	0	+ 15 0

* Observations of range party subject to doubt, as they could not see target.

correct result. First correction "subtract 20" was apparently not applied at guns, and was repeated for next salvo. Bracket incorrectly announced as 3400-3500.

Sixth officer's change of corrector by one mil, 22 to 21, was justified by necessity of getting bursts a trifle lower on a very indistinct target. Correction "add 20" at second salvo was incorrectly applied at guns, giving cross fire.

Seventh officer gave commands in wrong sequence. Change of corrector to 22 not justified. Observations of range party on this target doubtful, as target not clearly seen.

FORTY-EIGHTH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 14.)

School Practice No. 14.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. April 29, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	4500	American battery 4 guns, 4 caissons and observing party.	35	0	0	8	0	3′ 20″ (Relieved)
2	4500	American battery 4 guns, 4 caissons and observing party.	35	0	0	14	0	5′ 46″ (5′ 46″)
3	2500 to 2000	Moving target, Cav. advancing at gallop.	8 (8)	0	0	4	0	3′ 00″ (3′ 00″)
4	2400	Infantry, 185 × 10 yards.	64	5	8	12	0	4′ 53″ (4′ 53″)
5	2400	German Machine gun battery, 4 guns.	22	0	0	6	0	2′ 00″ (2′ 00″)
6	?600	Trench.	4	0	0	12	0	4′ 45″ (4′ 45″)
7	3200	American battery, 4 guns, 6 caissons and observing party.	38	1	2	24	0	9′ 30″ (9′ 30″)

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908, 3″ Field Guns, Models of 1902, '04, '05. Charge 26 1-6 ozs. M. V. 1700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb., Model 1907. Lot 113, 1910.

Critique.—First officer fired at wrong target. Made bad error in deflection at first, and corrected poorly. No warrant for repeating 2400 after surely sensing shots; second observation, however, was correct. Required excessive time (8½ minutes) to compute firing data.

Second officer.—As he was simply shifting to new target, most of data given unnecessary; "subtract 90, angle of site 302," and new range would have been sufficient. Change in corrector should have been over 2 mils. Incorrect observation at 4500 gave wrong bracket.

Third officer fired at moving target; firing interfered with by delay at battery and by red flag displayed by range party. On second target, most of first data superfluous. Large error in first deflection

No. Sec.	Commands given.	No. Rds	Range	Observation: At battery	H.B.	Range party	
	No. 1.				*Mils.*	*Yds.*	
3	Bt. at, A.P. L pl adj pl, by pl fr R, D.3060	1	2400	? N	B	— 1800	+2
4	— 10, A.S. 298, Cr. 24	2	"	? N	B	— 1800	+2
3	Add 300	3	2400	+ L	B	— 2800	?
4		4	"	+ L	B	— 2800	?
3	Subt. 80	5	2000	— N	B	— 2800	
4		6	"	— H	B	— 2800	
3	Cr. 22	7	2400	— g	g	— 2800	
4	(Fired at wrong target)	8	"	— g	1	— 2800	
	No. 2.						
1	Bt. at, R pl adj pl, A.P. by pl fr R	9	3600	— B	1	— 770	4?
2	Subt. 90, A.S. 302, Cr. 22	10	"	— g	3	— 820	3?
1	Subt. 30, Cr. 24	11	4000	? L	1	— 420	3
2		12	"	— g	g	— 330	g
1		13	4400	— g	g	— 85	g
2		14	"	— L	g	— 30	2
1		15	4800	+ g	g	+ 330	g
2		16	"	? B	g	+ 375	g
1		17	4600	+ L	g	+ 155	1
2		18	"	? L	g	+ 105	g
1		19	4500	? L	g	+ 110	g
2		20	"	? L	g	+ 95	g
1	Subt. 5, inc. by 3	21	4500	? L	g	+ 25	g
2	Announced bracket 4500-4600	22	"	— L	g	+ 90	g
	No. 3 (1*st Target*)						
1	Bt. at, Add 300,* Add 60, V.F. 1 rd	23	3000	? L	B	+ 1100	5
2		24	"	? L	Lost	+ 1100	6
1	Add 200	25	2000	? L	3	+ 110	9
2		26	"	? L	12	+ 110	4
	Cr. 20, C.F. As you were		1600	Not fired.			
	(*Second Target*)						
1	Change target, A.P. R pl adj pl, by pl	27	2600	? H	6	+ 125	18
2	fr R, Subt. 130	28	"	? B	B ?	+ 100	2
1	Subt. 70	29	2600	? H	7	+ 250	18
2		30	"	+ B	B?	+ 230	2
1		31	2200	— H	8	— 125	16
2		32	"	— L	3	— 230	14
1	Cr. 22	33	2400	? V	9	+ 25	28
2		34	"	? L	2	T	7
1	Cr. 18	35	2400	? V	10	+ 35	32
2		36	"	+ B	B	+ 140	2
4	L pl adj pl, by pl fr L	37	2300	+ g	B ?	— 25	2
3		38	"	— g	0	— 30	g
	No. 4.						
4	Subt. 120	39	2200	— L	1	— 225	16
3		40	"	— L	g	— 250	18
4		41	2600	+ B	B	+ 285	—1
3		42	"	+ L	0	+ 295	—1
4		43	2400	+ B	B	+ 80	2
3		44	"	+ B	B	T	—1
	No. 5.						
4	Add 280	45	2800	+ g	B	+ 155	g
3		46	"	+ B	B	+ 160	—1
4		47	2400	— g	g	— 140	3
3		48	"	? V	20	— 150	120
4		49	2600	— g	0	— 5	2
3		50	"	? g	0	— 10	2
4	Cr. 23		2400	Did not fire.			
3		51	"	— L	1	— 215	4
4			2500	Did not fire.			
3		52	"	— N	3	— 130	5
4		53	2700	+ g	0	+ 5	g
3		54	"	? g	0	+ 10	g
4		55	2600	— g	0	— 20	2
3		56	"	? N	3	— 95	5

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	No. 6.					
1	Bt. at. R pl adj pl, by pl fr R. Subt.	57	2400	— g	0	— 750 3
2	210, A.S. 298, Cr. 24	58	"	— g	0	— 760 2
1		59	2800	? g	0	— 350 2
2		60	"	? B	B	— 355 2
1	Cr. 26	61	2800	— g	B	— 380 2
2		62	"	— L	3	— 435 4
1		63	3200	— L	0	— 40 1
2		64	"	? N	3	— 40 5
1		65	3600	+ B	B	+ 345 —1
2		66	"	Lost	Lost	+ 320 —1
1		67	3400	+ L	g	+ 195 —1
2		68	"	+ L	g	+ 200 2
1		69	3300	+ L	g	+ 90 g
2		70	"	+ L	1	+ 80 g
1		71	3200	? L	3	— 15 5
2		72	"	? g	0	— 40 g
1		73	3200	? L	3	— 30 3
2		74	"	? g	g	+ 10 g
1		75	3100	? g	g	— 45 g
2		76	"	? L	2	— 115 5
1	Cr. 25	77	3100	?	g	— 100 g
2		78	"	? g	g	— 90 g
1	Cr. 27	79	3000	— L	3	— 250 2
2		80	"	— N	3	— 235 8
	All the guns, V.F. 1 rd, Cr. 27 Announced bracket 3000-3100.		2900	Not fired.		

* Cease firing given for safety; add 60 given after this for further correction for moving target.

change. Error in height of burst of shots from first piece probably due to bad quadrant setting; correctly changed adjusting platoon to get more normal results. Should have been satisfied with bracket 2200-2400, target being infantry.

Fourth officer ranged on crest against nearly invisible target, and quickly got required 200-yard bracket. Had he fired again, should have raised corrector.

Fifth officer lost track of his ranges; wasted three salvos at 2400, 2500 and 2600.

Sixth officer.—Some of firing data superfluous. First change of corrector too small according to previous observations. Got 100-yard bracket at 70th shot, but forgot ranges, and finally announced bracket 3000-3100, without having sensed a shot at 3100. Should not have made last two changes in corrector.

FORTY-NINTH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 15.)

School Practice No. 15.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Condition of observation: Excellent. May 1, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	3800	American battery.	33 (0)	1 case hit pierced caisson shield.	1*	14	0	10′ 15″ (10′ 15″)
2	3400	American battery	35 (0)	1 (0)	1	20	0	11′ 15″ (11′ 15″)
3	3200	Infantry lines.	60	4	7	8	0	4′ 17″ (4′ 17″)
4	2000	American battery.	33 (0)	1 case hit pierced caisson shield.	1*	15	0	6′ 34″ (6′ 34″)
5	1500	Machine gun battery.	25	4	5	12	0	6′ 47″ (6′ 47″)
6	1500 to 1000	Advancing cav'ry	8 (8)	0	0	2	0	20″

*Effect of 1st and 4th problems.
*Includes 1′ 10″ to run guns to crest.
Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908, 3″ Field Guns, Model 1902, '04, '05. Charge 26 1-6 ozs. M. V. 1700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb., Model 1907. Lot 113, 1910.

Critique.—First officer.—With wind as it was, should have fired from left; lost bursts because masked by smoke. Bad setting at guns gave cross fire and generally poor distribution. Deflection corrections too timid. Angle of site too high. Time required too great.

Second officer not allowed to fire, from considerations of safety.

Third officer made deflection changes in wrong direction, and generally handled deflection poorly. Should have fired from left. Angle of site too high. Should have lowered corrector from 24 sooner. First change of corrector, 25 to 24, was too small. Sensed bursts that were too high. Forgot sense of 2800 and fired several more salvos at that range; resulted in different observation, on account of shift of sheaf. Time and ammunition expenditure too great. Problem not solved.

Fourth officer made error in first deflection, and corrected it at once. The 41st and 42d shots, and change of corrector to 26, were superfluous.

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	No. 1.					
					Mils.	*Yds.*
1	Bt. at, R pl adj pl, A.P. by pl fr R, D 4690	1	2800	? N	3	— 500 + 7
2	—1, A.S. 300, Cr. 25	2	"	— N	6	— 500 + 9
1	Subt. 50	3	3200	? N	6	— 500 6
2		4	"	? N	3	— 510 6
1	*Cr. 22	5	3200	? N	3	— 525 A ?
2		6	"	? N	3	— 475 A ?
1	Add 20	7	3200	— N	1	— 475 A ?
2		8	"	— N	2	— 450 A?
1	Add 5, increase by 5	9	3600	? H	0	— 10 4
2		10	"	? N	6	— 10 7
1	Add 5, Cr. 18	11	3600	? G	G	— 10 G
2		12	"	? N **	3	— 10 4
1		13	3600	T L	0	— 10 2
2		14	"	? L	2	— 8 3
	V.F. 1 rd, Cr. 20		3500	Not fired.		
	No. 2.					
	Bt. at, T. R pl adj pl V.F. 1 rd, D.O, C.F.		2000	Not fired.		
	No. 3.					
1	Bt. at. R pl adj pl, by pl fr R, D 5310	15	2400	— N	9	— 750 20
2	+5, A.S. 300, Cr. 25, A.P. Subt. 60	16	"	Lost	Lost	— 750 17
1	Add 20, Cr. 24	17	2800	— N	8	— 210 26
2		18	"	Lost	Lost	— 200 27
1	Add 20	19	3200	? N	8	+ 70 30
2		20	"	? N	Lost	+ 120 32
1	Subt. 50	21	3200	? H	10	+ 99 30
2				Did not fire.		
1	Cr. 16	22	3200	? N	6	+ 210 12
2				Did not fire.		
1	Cr. 10	23	3200	+ G	0	+ 330 1
2		24	"	Lost	Lost	+ 350 G
1	Subt. 5, Cr. 12	25	2800	? L	3	T 6
2		26	"	? G	—1	+ 80 G
1	Subt. 5	27	2800	? N	3	T 5
2		28	"	Lost	—B	— 10 6
1	Cr. 10	29	2800	+ L	2	+ 15 6
2		30	"	+ G	— B	+ 35 1
1	Subt. 5	31	2600	? L	3	— 140 4
2		32	"	— G	— G	— 130 G
1	Subt. 5	33	2700	— L	0	— 15 2
2		34	"	— G	G	— 20 G
	All the guns, V.F. 1 rd, Cr. 12		2600	Not fired.		Ricochet ?
	No. 4.					
1	Bt. at, R pl adj pl, by pl fr L, Subt.	35	2400	— G	— 3	— 280 —1
2	340, A.S. 290, Cr. 20, Add 80	36	"	— G	—G	— 260 G
1	Subt. 40, Cr. 25	37	2800	+ G	G	T G
2		38	"	T G	0	T 2
1	Cr. 30	39	2800	+ N	5	— 90 4
2		40	"	T N	5	— 80 4
1	Subt. 10, steady, Add 10, Cr. 26	41	2700	— L	0	— 120 0
2		42	"	— G	G	— 120 G NB
	All the guns, V.F. 1 rd, Cr. 30		2700	Not fired.		
	No. 5.					
	A.P. R pl adj pl, by pl fr L. D 4400—1	43	2400	+ H	15	+ 300 22
4	A.S. 300, Cr. 25	44	"	+ H	15	+ 300 22
3		45	2000	? H	15	T 24
4		46	"	? H	15	— 15? 13
3	Cr. 17	47	2000	+ H	9	+ 100 15
4		48	"	+ H	7	+ 110 14
3	Cr. 12		1600	Did not fire.		
4		49	"	? L	0	— 170 1

No. Sec.	Commands given.	No. Rds	Range	Observation At battery	H.B.	Range party
3		50	1600	? L	3	— 160 5
4		51	"	— L	5	— 160 5
3		52	1800	? L	4	+ 35 7
4		53	"	? L	3	+ 70 7
3	Cr. 10	54	1800	? L	5	+ 60 7
4		55	"	+ L	2	+ 115 5
3	Subt. 15	56	1700	— L	5	— 85 9
4		57	"	? L	4	— 15 6
	All the guns, V.F. 1 rd, Cr. 12		1600	Not fired.		
	No. 6.					
3	Bt. at. R pl adj pl, by pl fr L. A.S. 295,	58	2000	? N	9	+ 320 24
4	Cr. 20. Add 800	59	"	? N	9	+ 340 24
3	Subt. 20. Cr. 15	60	2000	? N	7	+ 460 24
4		61	"	? N	5	+ 480 18
3	Subt. 15. Cr. 10	62	2000	? N	4	+ 520 23
4		63	"	+ N	4	+ 550 22
3	Cr. 5	64	1600	+ L	0	+ 290 9
4		65	"	? N	2	+ 275 12
3		66	1200	— L	0	— 55 4
4		67	"	— L	0	— 25 4
3	Subt. 20	68	1400	+ L	1	— 130 8
4		69	"	+ L	1	— 100 8
	All the guns, V.F. 1 rd, Cr. 8		1100	Not fired.		
	No. 7.					
3	V.F. 1 rd, Subt. 180, Can you see that target; if you can D.10.	70	800	No sensing.	15	— 15
4	R. 1000	71	"		15	+ 10
	Subt. 100, steady Subt. 200		1000	Not fired.		

* Firing stopped to find cause of error in deflection.
** Fragments beyond target.

Fifth officer.—Angle of site estimated, and too high. Should have lowered corrector on second salvo. Changed corrector by creeping; too high throughout. Deflection when ready to fire for effect was 30 mils off. Not solved.

Sixth officer.—Data in wrong order. Bursts that were very high called normal. Made deflection changes by creeping, but this partly due to complication with range errors. Angle of site too high. Corrector too high.

Seventh officer.—Problem not solved because of confusion at guns, which were badly placed, and on part of officer himself.

FIFTIETH EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 16.)

School Practice No. 16.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. May 3, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective	Bracket	Fire for effect	(Time to determine bracket)
1	2500 to 2000	Moving Infantry approaching.	9	1	1	12	0	2′ 47″ (2′ 47″)
2	3500	Battery of 4 sections.	35	2*	2	12	12	8′ 45″ (4′ 53″)
3	4500	American battery, 4 sections, 2 flank caissons.	35	1**	1	15	12	10′ 10″ (7′ 10″)
4	2700	Infantry skirmish line.	61	1	1	6	0	2′ 34″ (2′ 34″)
5	1000 to 1500	Moving target, cavalry, retiring at trot.	8 (8)	0	0	0	0	No firing
6	2000	Machine Gun battery, 4 sections	21	0	0	6	0	1′ 42″ (1′ 42″)

* 1 direct hit on gun shield, 1st section. 41 shrapnel bullet hits on shields N. E.
** 5 non-effective hits on gun and caisson shields, 3rd section.
Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Charge 26 1-6 ozs. M. V. 1700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb. Model 1907. Lots 112 and 113, 1910.

Critique.—First officer.—After change in angle of site it was still too high. Corrector not lowered as soon as it should have been. Problem poorly handled; with slowly moving target should have tried for 200-yard bracket. Problem regarded as solved, but poorly.

Second officer.—Problem well solved. Error in announcing firing data, and, as results showed, should not have lowered corrector to 25.

Third officer.—First deflection change should have been 100 mils. Corrector not changed until 4th salvo, as first was far to left and only one shot fired in second. Change of corrector from 32 to 31 too small, being within error of matériel. Became confused at 50th shot, and announced range 4600, but corrected before guns fired. At end, distribution had not been properly corrected.

Fourth officer.—Firing data in wrong order. Announced wrong range, 2400, but corrected before guns fired.

Fifth officer.—Firing at first simulated against machine-gun target; changed for actual fire against moving target, but because of misunderstanding at battery, and from considerations of safety, no

No. Sec.	Commands given.	No. Rds	Range	Observation At battery	H.B.	Range party
	No. 1.				*Mils.*	*Yds.*
	Bt. at. A.P. by pl. fr L, D.6320+					
3	4 A.S. 295, Cr. 23, Change A.S. 290,	1	2400	— L	6	+ 70 9
4	V. F. 1 rd	2	"	— L	9	+ 70 9
3	Subt. 20	3	2800	? N	9	+ 350 12
4		4	"	? N	9	+ 350 12
3	Add 40	5	1500	— N	10	— 300 G case
4		6	"	— N	8	— 450 6
3		7	1600	— H	9	— 500 + 10
4		8	"	— H	10	— 500 + 10
3	Cr. 15	9	1700	— N	9	— 200 10
4		10	"	— N	1	— 250 6
3	Cr. 12	11	1700	— H	3	— 250 8
4		12	"	— H	3	— 280 10
	All the guns. V.F. 1 rd		1700	Not fired		
	No. 2.					
	Bt. at. A.P. R pl adj pl, by pl fr L,					
3	A.S. 290, steady, D.6320+5, A.S.	13	2500	— L	g	— 640 +2
4	290 Cr. 20	14	"	— L	1	— 640 +2
3		15	2900	— L	1	— 430 +3
4		16	"	— G	G	— 420 +2
3	Subt. 5	17	3300	— G	G	— 50 +1
4		18	"	— N	3	— 65 G
3	Dim. by 3, Cr. 22	19	3700	+ G	G	+ 240 G
4		20	"	+ G	G	+ 315 G
3		21	3500	+ G	G	+ 15 G
4		22	"	+ G	G	+ 65 G
3	Cr. 25	23	3400	— L	0	— 15 0
4		24	"	? N	3	T +2
4	By battery from the right	25	3400	T L	3	— 15 +2
3		26	"	T L	4	— 40 +3
2		27	"	T G	0	— 40 G
1		28	"	T L	B	— 40 G
4	V.F. 1 rd. Cr. 27	29	3300	— H	7	— 170 +6
3		30	"	— H	7	— 170 +6
2		31	"	— H	5	— 170 +6
1		32	"	— H	4	— 60 G
4	Cr. 25	33	3350	— L	0	— 85 0
3		34	"	— L	0	— 85 0
2		35	"	— L	G	— 85 0
1		36	"	— L	B	— 85 0
	No. 3.					
3	Bt. at. R pl adj pl, A.P., by pl fr L	37	4200	? G	G	— 180 G
4	Subt. 60	38	"	? G	1	— 180 +1
3	Subt. 40		4200	Did not fire.		
4		39	"	— G	B	— 190 +1
1	L pl adj pl, by pl fr L	40	4600	— G	G	— 35 G
2		41	"	? G	G	— 15 G
1	Add 20, dim. by 2, Cr. 30	42	5000	+ B	B	+ 250 G
2		43	"	+ B	B	+ 205 +1
1	Cr. 35	44	4800	? N	4	+ 35 +5
2		45	"	? H	7	+ 18 +8
1	Cr. 32	46	4800	? L	1	+ 130 +2
2		47	"	? L	3	+ 80 +4
1	Cr. 31	48	4800	+ L	0	+ 72 0
2		49	"	? L	3	+ 125 +6
1	R. 4600, steady, as you were	50	4700	+ L	1	T +3
2		51	"	? N *	5	+ 10 +5
1	By battery from the L. Cr. 33	52	4600	— N	3	— 65 +4
2		53	"	— N	6	— 75 +7
3		54	"	— H	6	— 35 +5
4		55	"	? H *	8	— 30 +8
1	Add 5, dim. by 2, Cr. 32	56	4700	+ L	0	+ 15 0
2		57	"	? N	3	+ 50 +4
3		58	"	? N	5	+ 70 +5
4		59	"	? N	4	+ 50 +4
1	Subt. 15. V.F. 1 rd	60	4600	+ H	10	T +6
2		61	"	+ H	5	T +3
3		62	"	+ N	Lost	— 15 +10
4		63	"	Lost	G	T +9

No. Sec.	Commands given.	No. Rds	Range	Observation		
				At battery	H.B.	Range party
	No. 4.					
	Bt. at. Add 25, Cr. 25 by pl fr. L,					
3	Cr. 25	64	2800	+ L	3	+ 100 +4
4		65	"	? N	3	+ 75 +4
3	Cr. 22	66	2400	— 0	1	— 275 +3
4		67	"	— B	B	— 200 +1
3	R. 2400	68	2600	— 0	0	— 25 0
4		69	"	— 0		
	All the guns, V.F. 1 rd, Cr. 25		2500	Not fired.		
	No. 5.					
	R pl adj pl, A.P. by pl fr. L. D. 6220 +5, A.S. 290, R 2400, Cr. 25		2400	Not fired		
	Subt. 200, Cr. 20		1400	" "		
	Change to left pl		1800	" "		
1	Bt. at. Add 200, Cr. 25	70	2400	? L **	G	+ 450 B
2		71	"	? L	G	+ 475 B
1	Add 100	72	2000	— L	1	T G
2		73	"	? L	2	T 3
1	Add 10	74	2000	— L	2	— 20 2
2		75	"	+ L	2	T 3
	All the guns, V.F. 1 rd, Cr. 27		1900	Not fired.		

* Fragments over.
** Probably over.

shots fired. Sheaf then shifted back to machine-gun target for actual fire. Data given in wrong order, and deflection correction poor.

Shown that there is no "corrector for the day," because of various elements affecting it. Ordnance Department has plotted curves for temperature, density of atmosphere, and wind component in direction of range. Sometimes corrector increases with range, sometimes decreases; usually increases from 2500 yards up.

FIFTY-FIRST EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 17.)

School Practice No. 17.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. May 6, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Range Yards	Description	(animals)	(animals)	tive hits	Bracket	for effect	determine bracket)
1	2000 to 2500	Moving target, artillery carriage trot.	3 (3)	0	0	5	0	1′ 42″ (1′ 42″)
2	2600		NO FIRING					
3	2500	American battery,	39	3	3*	14	8	12′ 38″
		4 guns, 6 caissons						(11′ 28″)
4	3300	American battery, 4 guns, 4 caissons	35	4	5**	18	8	9′ 15″ (7′ 25″)
5	2800	Infantry line, prone 20×170 yds.	86	1	1	6	0	1′ 23″ (1′ 23″)
6	2500	Infantry trench	0	0	0	6	0	1′ 25″ (1′ 25″)

* 32 N. E. hits on 2nd and 3rd section, 1 effective hit on shield.
** 4 N. E. hits on men. 7 N. E. hits on shield.
Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Charge 26 1-6 ozs. M. V. 1700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb., Model 1907. Lots 112 and 113.

Critique.—First officer.—Intended as direct fire problem, but ofcer used indirect, which was extremely difficult as target was moving directly across range. Command "moving target, with shrapnel," given to indicate that actual fire was to begin, indicated to gunners that direct fire was to be used, and caused some confusion. Deflection changes were apparently guessed at.

Second officer did not fire; target not operating properly.

Third officer.—Direct fire problem. Gave deflection in wrong direction. Corrector too high after first change, until changed by creeping to 24. Should not have been changed from original 25 without further firing. Should have been raised when volley fire begun. Adjusting salvo at 2600 should not have been repeated. Did not get correct 100-yard bracket.

Fourth officer had a very difficult target, and ranging done on crest. Firing data in wrong order. Sense of first salvo not recorded, but regarded by officer as short. First salvo at 3,100 regarded by officer as short, but he fired further at same range. Improperly fired for adjustment at 3500 when he had already found 3400 over. Did not follow regulations in ranging. Should not

No. Sec.	Commands given.	No. Rds	Range	Observation At battery	H.B.	Range party
	No. 1.					
	Simulated fire at battery, R pl adj pl A.P., by pl fr R. D.3130—2, A.S. 300, Cr. 30. Moving target with					
3	shrapnel, Add 140, Cr. 30, R—	1	2600	? L	3	+ 180 10
	V.F. 7 rd.	2	"	? L	1	+ 245 10
4	V.F. 1 rd	3	2600	?	3	+ 190 14
4				Did not fire.		
3	Subt. 150	4	2600	+ N	3	+ 60
4		5	"	+ L	0	+ 40 8
	Subt. 80		2400	Not fired.		
	No. 2.					
	L. pl adj pl, D 3025—2, A.S. 300, Cr. 27, by pl fr. R. T. D. 0		2600	Not fired. Target failed to operate properly.		
	No. 3.					
3	R pl adj pl, T. by pl fr L. D 6395,	6	2400	?	G	— 40 G
4	Cr. 25	7	"	?	3	— 45 3
3		8	2400	—	1	— 25 3
4		9	"	—	G	— 60 G
3	Cr. 30	10	2800	? H	6	+ 210 11
4		11	"	? H	5	+ 265 10
3	Cr. 27	12	2800	Lost	V	— 320 60
4		13	"	+ H	3	+ 265 8
1	Cease firing, L pl adj pl by pl fr L.	14	2600	— H	3	+ 65 8
2		15	"	— H	2	+ 130 8
1	Cr. 25	15	2600	— H	3	+ 135 6
2		17	"	— H	2	+ 130 5
1	L piece subt. 2, Cr. 24	18	2700	+	1	+ 210 1
2		19	"	+	G	+ 290 2
1	V.F. 1 rd, Cr. 24, All the guns	20	2600	+	B	+ 130 2
2		21	"	+	B	+ 145 3
3		22	"	+	0	+ 170 1
4		23	"	+	B	+ 175 G
1	Cr. 26	24	2500	—	0	+ 12 5
2		25	"	—	B	+ 32 6
3		26	"	—	2	+ 80 0
4		27	"	—	1	+ 80 2
	No. 4.					
4	R pl adj pl, A.P. D 6100+3, Cr. 25.	28	3000	? G	B	— 310 G
3	A.S. 300, by pl, fr R	29	"	? G	B	— 310 G
4	Add 40	30	3400	+ L	B	+ 100 1
3		31*	"	+ L	B	+ 72 G
4	Subt. 20	32	3000	? V	V	— 500 + V
3		33	"	— L	G	— 325 G
4	Cr. 27	34	3200	? L	1	— 110 2
3		35*	"	+ G	G	— 155 G
4	1st or 2nd crest?	36	3100	G	G	— 230 G
3		37	"	G	G	— 225 G
4		38	3500	+ L	B	+ 175 —1
3		39	"	Lost	Lost	+ 140 0
4		40*	3100	— L	G	— 260 G
3		41	"	— L	G	— 265 G
4	Cr. 28	42	3300	+ L	B	+ 45 G
3		43	"	+ L	1	T 2
4		44	3150	— G	G	— 220 G
3		45	"	— G	G	— 240 G
1	All the guns, R. Cr. 33, V.F.1 rd.	46	3100	— H	3	— 360 10
2		47		— H	3	— 360 10
3		48	"	— H	3	— 375 10
4		49	"	— H	4	— 375 10
1		50	3200	— H	1	— 375 15
2		51	"	— H	3	— 260 10
3		52	"	— H	4	— 200 12
4		53	"	— H	6	— 190 9

No. Sec.	Commands given.	No. Rds	Range	Observation At battery		Range party	
	No. 5.						
2	Bt. at. A.P. L pl adj pl. by pl fr. R	54	2400	— L	2	— 265	2
1	Subt. 110, A.S. 300, Cr. 25	55	"	— B	—1	— 250	2
2		56*	2800	— G	G	— 15	G
1		57	"	+ G	G	+ 10	G
2	Cr. 28	58	2800	— L	3	— 58	2
1		59	"	+ L	1	+ 10	3
	All the guns, V.F.1 rd, Cr. 27 (Would give Cr. 30.)		2700	Not fired.			
	No. 6.						
	Bt. at. L pl adj pl. A.P. by pl fr R		1800	Not fired.			
	Add 150, A.S. 298, Cr. 23, Make R						
2	2600	60	2600	+ G	G	+ 100	G
1		61*	"	+ G	G	+ 85	G
2	Cr. 25	62*	2400	— G	G	— 90	G
1		63*	"	— G	G	Lost	
2	Cr. 27	64	2500	+ L	0	+ 40	1
1		65	"	— L	0	T	1
	All the guns, V.F.1 rd, Cr. 29		2450	Not fired.			

*Failed to explode on impact.

have raised corrector from 28 to 33, and should have reduced it when he observed high bursts.

Fifth officer.—Repeating aiming point superfluous. Fired again at 2800 after bracketing salvo, to get corrector; might have been as well to go at once to volley fire with 5 mil raise in corrector, to get immediate effect and adjusted corrector on next volley. "Corrector 27" given by mistake, and changed.

Sixth officer underestimated range at first, and was directed to change to save ammunition. Changed corrector by creeping.

FIFTY-SECOND EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Report No. 18.)

School Practice No. 18.

Battery "B" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. May 8, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	1200 to 1800	Moving target, retiring cavalry, trot.	8 (8)	3 (4)	23*	9	0	1′ 16″ (1′ 16″)
2	3100	Machine Gun Battery.	20	0	0	12 N. B.	0	4′ 26″

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
3	4600	American Battery	34	1	2	12 N. B.	0*	2′ 34″
4	2500 to 2000	Advancing Infantry	12	0	0	12	0	3′ 13″ (3′ 13″)
5	3000	American Battery	34	*2	2	8	0	2′ 10″
6	2800	Line of infantry	62	º??0	0	8	0	2′ 14″ (2′ 14″)

*1 Case (or shrapnel head) hit.
º??1 Ineffective hit.
Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns, Model 1902, '04, '05. Charge 26 1-6 ozs. M. V. 1700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.
Fuze: F. A. 21 sec. comb., Model 1907. Lots 112 and 113, 1910.

Critique.—First officer.—Third shot fired through error at gun. Officer at first thought target approaching. Observation of heights of burst not accurate.

Second officer had difficult target, which he could see only part of time. Sensed bursts badly, and did not follow his observation in first salvo. Did not shift to most visible part of target. Not solved.

Third officer had excellent target, estimated range well, and was proceeding with good solution, but forgot ranges and dropped to 4200. Problem not solved.

Fourth officer.—Time too long. Estimated range badly. Corrector too high. Heights of burst estimated poorly. Last two salvos fired after target had finished run.

Fifth officer.—This was a case where change from first range should have been 200 yards, as target was on a slope and distance of burst could be estimated. Because of slope it was safer to leave corrector unchanged in spite of grazes, as was done.

Sixth officer did not range upon most visible part of target, and had poor distribution; 59th shot, and perhaps 58th, might have been sensed if sheaf had been properly on target.

No. Sec.	Commands given.	No. Rds	Range	Observation: At battery	Observation: H.B.	Observation: Range party
	No. 1.				*Mils.*	*Yds.*
	Bt. at. L pl adj pl, A.P. by pl fr.		2600	Not fired.		
	L, A.S. 297, Cr. 25, D 5640+4	Registration data.				
3	T. V.F.1 rd	1	1600	+ L	G	+ 100 G
2		2	"	+ L	3	— 50 4
1		3	"	+ L	3	Lost.
3		4	1400	— L	1	— 250 4
2		5	"	— L	5	— 200 9
3		6	1800	+ L	???	+ 75 1
2		7	"	+ L	3	+ 75 4
3		8	1800	— L	0	— 50 4
2		9	"	— L	4	— 50 4
	No. 2.					
3	Bt. at. R pl adj pl. A.P. by pl fr L.	10	3000	— G	G	— 20 G
4	D 6165+4, A.S. 295, Cr. 23	11	"	+ B	B	— 70 7
3		12	2600	+ B	B	— 240 G?
4		13	"	? L	3	— 50 2
3	Add 10	14	2400	? L	2	— 250 2
4		15	"	+ B	B	— 280 3
3	Add 10	16	2200	— B	B	— 300 1?
4		17	"	— 0	B	— 300 9
3		18	2600	— L	2	— 200 2
4		19	"	Lost	Lost	— 270 G?
3		20	3000	? G	G	— 2 G
4		21	"	? G	G	— 10 G
	No. 3.					
3	R. pl adj pl, A.P. by pl fr L. D0+4,	22	4800	? N	7	? 22
4	A.S. 300, Cr. 32	23	"	? N	5	? 7
3	Add 10, Cr. 28	24	4800	+ G	G	+ 90 G
4		25	"	+ L	1	+ 98 0
3		26	4400	— G	G	— 270 —7
4		27	"	? N	4	— 247 B
3	Increase by 5	28	4200	— N	3	— 465 7
4		29	"	— N	1	— 465 G?
3	Add 10, Diminish by 2, Cr. 25	30	4300	— G	G	— 315 G?
4		31	"	— G	G	— 375 G?
3		32	4400	— L	0	— 300 0
4		33	"	— G	G	— 240 0
	No. 4.					
4	Bt. at. A.P. R pl adj pl. by pl fr R.	34	3000	? N	7	+ 500 + 3
3	D 140+4, A.S. 303, Cr. 25	35	"	? N	8	+ 500 + 3
4	Add 20, Cr. 22	36	3000	+ L	6	+ 500 + 5
3		37	"	+ G	G	+ 500 + 1
4		38	2600	+ L	6	+ 525 4
3		39	"	+ L	3	+ 525 2
4	Add 30	40	2200	+ L	6	+ 165 10
3		41	"	+ N	7	+ 195 9
4	Add 15	42	1800	— N	7	— 225 12
3		43	"	— N	6	— 240 9
4	Diminish by 2	44	1800	— N	8	— 210 12
3		45	"	— N	7	— 172 14
	Diminish by 2		"	Cease Firing		
	No. 5.					
4	Subt. 100	46	3000	— G	Lost	— 45 G*
3		47	"	— L	1	— 37 1
4		48	3400	+ G	G	+ 150 G
3		49	"	+ G	G	+ 135 G
4	Increase by 2	50	3200	+ G	G	+ 90 G
3		51	"	+ G	G	+ 60 G
4	Increase by 4	52	3100	+ G	G	+ 52 G
3		53	"	+ G	G	+ 52 G
	All the guns, V.F.1 rd, Add 2, Cr. 24		2900	Not fired.		

No. Sec.	Commands given.	No. Rds	Range	Observation: At battery		Observation: Range party	
	No. 6.						
4	Bt. at. Subt. 270, R pl adj pl, by pl	54	3000	+ L	3	+ 145	4
3	fr R. Cr. 22	55	"	? N	5	+ 80	10
4		56	2600	? N	4	— 200	5
3		57	"	— H	6	— 200	7
4	Cr. 20	58	2800	? N	3	T	5
3		59	"	? G	G	+ 3	0
4	Add 10	60	2800	? L	2	T	3
3		61	"	— G	G	— 5	B*
	All the guns, V.F.1 rd, Increase by 2, Cr. 22.		2700 Not fired.				

*Did not explode.

FIFTY-THIRD EXERCISE.

Field work, panoramic sketching and actual firing. (Practice Re port No. 19.)

School Practice No. 19.

Battery "A" of the 5th Regt. of Field Artillery. Fort Sill, Oklahoma.
Conditions of observation: Excellent. May 10, 1912.

Targets.				Effect produced		Number of Rounds Fired.		Total Time of Fire.
No.	Map Range Yards	Description	Men (animals)	Men (animals)	Effective hits	Bracket	Fire for effect	(Time to determine bracket)
1	2500 to 2000	Infantry advancing 9 Figures	9	0	0	6	0	2′ 7″ (2′ 7″)
2	3500	American battery, 4 guns, 6 caissons	40	a2	†4	16	4	7′ 01″ (6′ 27″
3	3800	American battery, 4 guns, 4 caissons	33	2	‡1	14	8	7′ 49″ (5′ 23″)
4	2800	Machine gun battery, 4 sections	22	b1	2	12	0	4′ 40″ (4′ 40″)
5	3800	Infantry trench.	3	0	0	8	0	3′ 01″ (3′ 01″)
6	2400	Infantry skirmish line	60	3*	4*	8	0	1′ 44″ (1′ 44″)
7	3400	Infantry trench.	3	0	0	8	0	2′ 49″ (2′ 49″)
8	3000	American battery, 4 guns, 6 caissons	40	a2	†4	10	0	3′ 38″ (3′ 38″)
9	2500	Machine Gun battery, 4 sections	22	b1	2	6	0	1′ 47″ (1′ 47″)

a (2) & (8) fired at same target.
b (4) & (9) fired at same target.
‡ Direct hit on caisson. 22 N. E. hits.
†34 N. E. hits on shields.
*1 N. E. hit.

Shrapnel: Nitro Cellulose Powder. Picatinny Arsenal. Lot 1, 1908. 3″ Field Guns. Model 1902, '04, '05. Change 26 1-6 ozs. M. V. 1,700 F. S. Pressure 30,000 lbs. 110 grain percussion primer and ¼ oz. igniter.

Fuze: F. A. 21 sec. comb. Model 1907. Lots 112 and 113, 1910.

No. Sec.	Commands given.	No. Rds	Range	Observation: At battery	H.B.	Range party
	No. 1. (Simulated Fire)				*Mils.*	*Yds.*
3	Change T. T. by pl fr L. Cr. 25	1	2000	— H		
4				Did not fire.		
3		2	1600	— H	6	— 500 + 2
4		3	"	— H	3	— 500 + 2
3		4	1800	— L	4	— 500 + 2
4		5	"	— 0	0	— 500 + 2
3		6	2000	— ?	3	— 400 5
4				Did not fire.		
	No. 2.					
3	Change target, R. pl adj pl, A.P. by	7	2600	— L	3	— 500 + 6
4	pl fr L. D 6355, D. D. steady,+4 A.S. 290, Cr. 25	8	"	— L	3	— 500 + 6
3		9	3000	+ N	4	— 500 + 6
4		10	"	+ N	2	— 500 + 6
3	Cr. 23	11	2800	— L	2	— 500 + 3
4		12	"	— L	1	— 500 + 3
3		13	2900	—	1	— 500 + 3
4		14	"	+	3	— 500 + 6
3	All the guns, Cr. 25. (Instr. verify	15	3000	— ?	0	— 500 3
4	3000) Cr. 22, by pl fr L.	16	"	— ?	1	— 500 3
3		17	3400	+ G	G	+ 35 3
4		18	"	+ G	2	+ 50 3
3		19	3200	? H	6	— 275 4
4		20	"	— G	0	— 200 0
3		21	3300	+ G	0	+ 15 1
4		22	"	— G	0	— 20 1
1	All the guns. V.F.1 rd. Cr. 25	23	3200	- |	3	— 130 6
2		24	"	- L to	3	— 135 6
3		25	"	- | N	3	— 160 6
4		26	"	- |	1	— 170 6
	No. 3.					
4	Bt. at. Subt. 40, R pl adj pl by pl fr	27	3400	— L	3	— 390 0
3	R. Subt. 40, A.S. 292, Cr. 25	28	"	— G	B	— 390 0
4		29	3800	? N	3	T 6
3		30	"	+ G	B	T G
4		31	3600	— L	1	— 225 9
3		32	"	— L	2	— 250 9
4		33	3700	— G	G	— 70 G
3		34	"	— L	0	— 15 0
4		35	3800	? F	3	T 12
3		36	"	? L	1	— 70 G
4	By bat'y from the R. Inc. by 2	37	3800	+ L	G	+ 35 2
3		38	"	? H	3	— 40 12
2		39	"	+ L	G	T G
1		40	"	Lost	G	— 110 G
4	All the guns, V.F.1 rd. Cr. 27	41	3650	? H	4	— 140 12
3		42	"	— G	0	— 240 G
2		43	"	— L	1	— 245 G
1		44	"	Lost	4	— 140 12
4		45	3700	— G	G	— 110 G
3		46	"	— N	3	— 150 9
2		47	"	? N	3	— 195 9
1		48	"	Lost	0	— 110 G
	Diminish by 2, V.F. 1 rd.			Not fired.		
	No. 4.					
3	R pl adj pl, by pl fr L. Subt. 45,	49	3400	+ G	B	+ 500 + G
4	A.S. 292, Cr. 23.	50	"	+ L	2	+ 500 + —5
3		51	3000	?	1	+ 340 3
4		52	"	?	3	+ 325 3
3		53	3000	? L	2	+ 450 2
4		54	"	? L	1	+ 415 2
3	Add 10, Cr. 21	55	3000	+ L	B	+ 450 G
4		56	"	— G	B	+ 415 G
3	Subt. 5, V.F. 1 rd, Cr. 23, 2900, (Bn.	57	3000	+ G	B	+ 460 0
4	C. verify 3000) by pl fr L. Cr. 22.	58	"	+ L	1	+ 430 1
3		59	2600	— L	2	— 70 1
4		60	"	— L	2	— 85 0
			2800	Not fired.		

No. Sec.	Commands given.		No. Rds	Range	Observation At battery	Observation Range party
	No. 5.					
3	Bt. at. R pl adj pl, Add 40, by pl	61	3600	Lost	G	Lost.
4	fr L.	62	"	? V	23	— 500 + 90
3	(Bn. C. "You are a good deal to R.".	63	3600	Lost*	G	— 500 + G
4	Add 20	64	"	"	G	— 120 G
3	Add 10, R. 3600 (Bn. C. Range too short)	65	4000	? G **	B	Lost.
4		66	"	? N	3	+ 180 12
3		67	3800	+ G	G	+ 60 2
4		68	"	? L	G	T G
	No. 6.					
3	Bt. at. R pl adj pl, Add 80, by pl fr	69	2400	+ L	0	+ 10 B
4	L, A.S. 288, Cr. 22.	70	"	+ N	3	T 5
3	Subt. 10	71	2000	— L	B	— 300 2
4		72	"	— L	B	— 310 3
3		73	2200	— L	0	— 160 0
4		74	"	— L	3	— 150 1
3		75	2300	— L	2	— 60 4
4		76	"	— G	G	— 40 G
	All the guns, V.F.1 rd. Cr. 24		2200	Not fired.		
	No. 7. (Simulated fire)					
	T. D.0, Cr. 23, V.F. 1 rd. (From bat'y "cannot see target") Subt. 300.		1400	Instr. cease firing.		
	No. 8.					
3	Bt. at. R. pl adj pl, A.P. by pl fr L	77	4000	? H	5	+ 500 + 15
4	D. 6380+1, A.S. 300, Cr. 25	78	"	? H	8	+ 460 15
3	Cr. 22	79	4000	? N	3	+ 500 + 15
4		80	"	? N	3	+ 500 + 15
3	Subt. 30, as you were, Add 30, Cr. 20	81	4000	? } N to L	3	+ 500 + 9
4		82	"	? }	1	+ 500 + 9
3	Subt. 10	83	4000	+ L	B	+ 500 + 3
4		84	"	? N	2	+ 500 + 7
	R 3800, steady R		3600	Not fired.		
	No. 9.					
3	Bt. at. R pl adj pl, by pl fr L. Subt.	85	2200	? H	8	— 500 + 4
4	30, Cr. 23	86	"	— H	8	— 500 + 5
3		87	2600	? H	7	— 500 + 20
4		88	"	— B	B	— 340 1
3	Cr. 23	89	3000	? H	8	T 20
4		90	"	? H	9	— 15 20
3	Add 20, Cr. 20	91	3000	+ H	7	+ 50 26
4		92	"	+ N	5	T 15
3	Cr. 18	93	2800	— L	3	— 210 3
4		94	"	? H	7	— 260 20
	Cr. 16		2900	Not fired.		
	No. 10.					
3	Bt. at. Subt. 140, A.S. 300, Cr. 23	95	2600	Lost.	5	+ 280 3
4		96	"	— G	B	Lost.
3		97	3000	? —	5	+ 500 + 1
4		98	"	Lost	4	+ 500 + 1
3	Cr. 20	99	3000	— N***	3	+ 500 + 2
4		100	"	— ?	5	+ 500 + 3

*Shot fired with Range 3100.
**Smoke over.
***Fragments +, smoke —.

Critique.—First officer should have lowered corrector, according to his observation. Poor estimate of range, and observation of height not good.

Second officer.—Erroneous observation of 3000 and 2900 gave wrong bracket. Sensing of height in first salvo poor. Should not have raised corrector when he fired verifying salvo by order. Corrector 22 was too low.

Third officer repeated deflection change in giving data; might have caused double correction. Problem well carried out.

Fourth officer.—Should not have lowered corrector from 23 to 21. Erroneously thought 3000 bracketing salvo, and got wrong bracket; this salvo was plainly over. Corrector 23, as announced for fire for effect, would probably have been too low.

Fifth officer.—One shot for 3600 was fired at 3100; also probably one in first salvo. Did not handle corrector and deflection properly.

Sixth officer.—Problem well solved, against difficult target. Some estimates of height poor.

Seventh officer was to have fired at moving target; but when target designated it could not be seen at battery. Change to indirect fire not made in time to get onto target before run completed. Change of deflection ordered when no aiming point had been designated.

Eighth and ninth officers handled deflection and corrector poorly. Angle of site high.

Tenth officer.—Angle of site too high. Not enough ammunition at battery to complete problem.

DAIRIES 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.

APRIL.

Training Class. April 1 *to April* 30—*about* 1½ *hours per day*.

1. In hall 1¼ hours. Work at will; drill by threes; right (left) about, two track, halts, canter on both hands.
2. Outside 1¼ hours. Road work at walk and trot. Took course of log jumps in Sheridan woods.
3. Outside 1¾ hours. Run with wolf hounds.
4. Outside 1¼ hours. Road work and schooling over low jumps in Sheridan woods.
5. In hall 1 hour. Work-out by threes at trot and canter. Work at will. Individually, on left hand "haunches left" and change direct to "haunches in," "haunches right" and change direct to "haunches out."
6. Outside 1¼ hours. Trot and canter. Took three flights of low rail and log jumps at a canter in column.
8. In hall 1 hour. Work out and drill, same as 5th for individual work. Outside ¾ hours. Gallop 5 minutes, dismount, lead and graze when cool.
9. Outside 1¼ hours. Road work, and gallop over brush course on Republican Flats one mile.
10. In hall 1½ hours. Work-out. Work at will.
    "Shoulder in" on both hands, first at a walk and later at slow trot. Outside ¼ hour. Road work and grazing.
11. Outside 1½ hours. Scramble in ravines and woods, five jumps in the Magazine Cañon course.
12. In hall 1¾ hours. Work-out, drill by threes in exercises. Individually "shoulder in," at school trot on both hands. Work at will and canter.
13. Outside 1¼ hours. Road work and one and a quarter mile extended gallop, dismount, lead and graze.
14. In hall ½ hour. Work-out, work at will. Individually "shoulder in" and "shoulder out" on both hands.
    Outside 1¼ hours. Gaiting at 12-mile gallop on mile course in Sheridan woods.
16. Outside 1¼ hours. 1¼ miles over course of jumps on Republican Flats at gallop, walk and graze.
17. In hall 1¾ hours. Work-out, work at will, canter at will. Individually "shoulder out" on both hands.
18. Outside 1¼ hours. Gallop over brush jumps in the Magazine Cañon course.
19. In hall 1¼ hours. Work-out. Work at will. Individually "shoulder in (out)" and change of lead on change of circles and change of hands.
    Outside ½ hour. Road work.
20. In hall ¼ hour. Work-out.
    Outside 1¼ hours. Gaiting at 12-mile gallop on the course in Sheridan woods; lead and graze.
22. Outside 1¼ hours. Long trot. In column, first individual riders were sent off at a gallop to return at a trot, and then riders were sent off in pairs in the same manner.

23. Outside 1½ hours. Gallop in line jumping brush hurdle one at a time and in pairs.
24. Same as 23, only jumping by threes and fours.
25. In hall 1¼ hours. Work-out. Work at will. Individually change of leads on change of circles.
26. Outside 1½ hours. Jumping brush hurdle in line.
27. In hall 1 hour. Work-out. Work at will. Individually, change of leads.
29. In hall 1¼ hours. Work at will. Change of leads on changing hands.
30. Entire school to Ogden Flats for review. Assignment of breaking colts and muster of 1st and 2d training colts with a view to their disposition for new year.

School Class. April 1 *to April 30—about* 1½ *hours per day, Saturdays excepted.*

1. In hall 2 hours. Work by threes executing change of direction, by the flanks, individual abouts, halts, on two tracks, haunches in, obliques; practiced taking the lead (right and left) from a slow trot on straight lines. Executed change of lead in center of hall while at a gallop in column of troopers. Had whip exercise and rode individually over one 3-foot jump several times.
2. Outside 2 hours. Took log jumps in woods. From top of hill above cemetery, galloped to vicinity of Morris Hill and returned to stables via Magazine Cañon.
3. Outside 1 hour. Walk, trot and gallop.
   In hall 1 hour. Movements by threes, including two tracks and haunches in; change of lead in center of hall while riding in column on the diagonal. Whip exercise. Practiced, individually, shoulder in. Rode over two 3-foot jumps several times.
4. Outside 1 hour. Same as 3d, except some jumping added.
   In hall 1 hour. Review same as 3d, except whip exercise combined with jumping over very small hurdle.
5. Outside 1 hour and inside 1 hour. Review same as for 4th.
8. Outside 1 hour. In woods at walk, trot and gallop. Horses are temporarily weakened from the effects of warm weather, increased work and the shedding period.
   Inside 1 hour. Worked at will collecting and executing the various exercises. Changed lead on straight line while passing across hall at gallop. Practiced whip exercise while taking small jumps.
9. Outside 1 hour and in hall 1 hour. Review same as for 8th. Advance, work for a short while with reins in one hand only.
10. Outside 1 hour. Exercised in woods and took several jumps; also jumped two brush hurdles on Republican flats.
    In hall 1 hour. Described the seat, executed small circles on the haunches, haunches in, two tracks, and shoulder in.
11. Outside 1 hour. In pairs over the hills at walk.
    In hall 1 hour. Review same as for 10th.
12. Outside 1 hour. Rode in woods at trot and gallop and took several jumps, ranging from 3 ft. to 3 ft. 6 in.
    In hall 1 hour. Worked by threes at all gaits, practiced taking gallop on straight lines and turning on haunches.
15. Outside 1 hour. On road in pairs at walk.
    In hall 1 hour. Executed circles, figures of eight, two tracks, turns on the haunches, haunches in and shoulder in, taking gallop on straight lines and change of lead on straight lines.
16. Outside 1 hour. Took several 3-foot 6-inch jumps in woods. Rode down over Republican flats and took one ditch jump.
    In hall 1 hour. Review, same as 15th.

17. Outside 1 hour and in hall 1 hour. Review same as 16th.
18. Outside 1 hour. In woods at trot and gallop and jumped several 3-ft. 6-in. hurdles; also rode down over Republican Flats, took one rail and ditch jump, two brush jumps and returned to stables.
    In hall 1 hour. Worked individually (at will) and by platoon, collecting and executing circles, abouts, obliques, halts, haunches in, two tracks, shoulder in, backing and abouts on haunches.
19. Outside 1 hour. Jumped one 4-ft. fence on race track several times, one horse moving out at a time and remaining on far side of fence after making the jump.
    In hall 1 hour. Review same as 18th with change of lead at gallop on a straight line added.
22. In hall 1¼ hours. Work-out; by platoon, circles, by flanks, halts from trot and slow trot, change of lead at gallop, individually and by threes. Put horses through chute over one jump 3 ft. and one 3 ft. 8 in. high.
23. In hall 1¼ hours. Review same as 22d.
    Outside 2 hours. Went to see the four-mile ride of the 6th Field Artillery officers on Ogden Flats.
24. Outside 2 hours. Weighed horses, afterwards walked them; also grazed for a few minutes.
25. Outside 1¼ hours. Worked in woods at walk, trot and gallop, took several jumps not exceeding 3 ft. 6 in. and grazed a few minutes.
26. In hall 1 hour. Worked at slow trot, trot and gallop, executing circles, movements by flanks, abouts, halts, two tracks, shoulder in, haunches in, gallop with both leads, change of lead on curves and straight lines.
29. In hall 1 hour. Work-out for 10 minutes, executed the exercises by threes including change of lead on straight line. Jumped one hurdle 3 ft. 6 in. high several times.
30. Outside 3 hours. Attended garrison review on Ogden Fats.

Jumping Class. April 1 *to April* 30*—One to two hours per day.*

1. Outside. Gallop 1½ miles trying for a 20 mile per hour rate.
2. In hall. Work at will, suppling exercises.
3. Same as 1st.
4. In hall. Suppling exercises for riders and horses; jumping three times over three 3 ft. jumps on one side, 3 ft. 6 in. stone wall and triple bar on other.
5. In hall. Suppling and gaiting at will.
6. In hall. Suppling; galloping in pairs; riding and jumping without stirrups or reins, twice over 4 jumps 3 ft. high. 20 ft. apart.
8. Outside. Winding through woods well strung out in column at gallop over about 20 jumps up to 3 ft. 6 in.; individually over ten jumps 3 ft. 4 in.
9. Same as 8th.
10. In hall. Suppling exercises and jumping without riders through chute, jumps 3 ft. 8 in. to 4 ft.
11. Outside. In column at walk and gallop over 10 jumps 2 ft. 6 in. to 4 ft.; individually practicing 15 mile gallop for one mile, twice.
12. Outside. In race track over 5 board fences 4 ft. to 4 ft. 3 in. in column and by trooper.
13. In hall. Suppling exercises; galloping in pairs and threes; five jumps 3 ft. high scattered over hall taken from serpentine, twice at walk.
15. Outside. Over five 4-ft. post and rail jumps, walking between; inspected breaking colts in pasture.
16. Same as 15th.
17. Outside. Walk on road ½ hour.
    In hall. Six 3-ft. jumps on track taken at slow trot from circles tangent to jumps.

18. Same as 12th.
19. Outside. Individually over a 4-ft. post and rail four times; in line at gallop over ditch 8 ft. with guard rail, open ditch with brush 3 ft. 6 in. and plain brush 3 ft. 6 in.
20. In hall. Suppling exercises; jumping 5 jumps 3 ft. high 20 ft. apart, first time over with reins and stirrups, second without reins, arms folded, third no reins or stirrups, hands on thighs.
22. Outside. Leaving stables by trooper 2 minutes apart, walk ¾ mile, gallop 2 miles across rough ground and five post and rail jumps 3 ft. 10 in. to 4 ft. 3 in.; walk home.
23. Outside. Rode out to see 4 mile ride by artillery officers on Ogden Flats.
24. Outside—Quiet walk up and down hills.
25. Outside. Walk 30 minutes, slow trot 10 minutes, gallop 5 minutes over two 5-ft. ditches, 12-ft. water jump, two post and rails 4 ft. and 4 ft. 2 in.
26. Outside. Over water jump one by one.
27. In hall. Suppling exercises for horses and riders; jumps on track two 3 ft. 9 in bars, 3 ft. 8 in. stone wall, triple bar 4 ft. wide, over all at gallop.
29. Same as 8th.
30. Review with troops of garrison.

Second Training Class. April 1 *to* 30*—about* 1½ *hours per day.*

1. In hall. Longed as usual. Ridden at walk and trot in column and at will with practice in turning by the flanks. Also practice at will in halting from the walk and resuming the walk, and causing the horse to yield the haunches to the application of the leg for a few steps. Practice in mounting, dismounting, sitting in rear of the saddle and rolling around on the colt.
2. In hall. Same as the 1st.
3. In hall. Same as the 1st.
4. In hall. Same as the 1st, with the addition of more work in column, and first trooper from front to rear, yielding the haunches to the leg while in column. Taking the gallop for a short time on both hands.
5. In hall. Same as the 4th.
6. In hall. Same as the 4th.
8. In hall. Same as the 4th.
9. In hall 1 hour. Work at will, walk, trot and gallop; also in changing direction, in increasing and decreasing the gaits. Also the same in column and in threes at walk and trot. Clambering around over horses at will.
   Outside ½ hour. Wandering around in the vicinity of the hall at a walk.
10. In hall ¾ hours. Same as the 9th, with the addition of "on forehand half turn in reverse" at both walk and trot.
    Outside ¾ hours. On road and on flats. Put colts in close order line for the first time and moved at walk and trot. Changed directions by having the pivots slightly lessen the speed and the marching flanks slightly increase the speed without either side taking a new gait, this so as not to excite the colts by taking a new gait for a short distance.
11. In hall and outside. Same as the 10th.
12. In hall and outside. Same as the 10th.
13. In hall 1 hour. Work at will, in column and by threes. Taking the gallop with a true lead on both hands. On forehand half turn in reverse. Also a few steps in "on two tracks right (left) oblique." Outside ½ hour, wandering around in pairs.
15. Same as the 13th.
16. In hall ¾ hours. Same as the 13th, with the addition of accustoming the colts to noises such as drums and firing.

Outside ¾ hours. On road and flats at walk and trot in line. Also accustoming the colts to stone crusher and train.

17. Outside 1½ hours. Long walk, trot, and canter on flats and hills.
18. In hall ¾ hours. Usual work at will and by threes. Commenced backing a few steps at a time. Pounding of an oil can so as to accustom horses to firing and drums. Mounting and dismounting and rolling around on horses.
    Outside ¾ hours. Wandering around and letting horses graze.
19. Same as the 18th.
20. In hall 1 hour. Work at will and in column by the flanks, abouts, changing gaits, on forehand half turn in reverse, a little backing, also rolling around on horses.
22. In hall 1 hour. Work-out at will at slow trot and trot. Work by platoons executing serpentines, changes of direction, circles, on forehand half turn in reverse; displace haunches to inside along track at walk and slow trot, and to outside near track at end of diagonal. Work by threes executing by the flanks, halt, and backing at will.
    Outside ½ hour, wandering around in vicinity of riding hall.
23. In hall 1 hour. Work-out at will at trot and gallop, both hands. Exercises by platoons same as the 22d. Accustoming the colts to the saber by using the whip in executing cuts, right, left, and rear moulinet, points, etc. While passing in opposite directions whips of opponents were struck by reaching well out with arm extended. Formed in line and executed movements by fours at walk.
    Outside ½ hour. Walk on soft ground and grazed.
24. In hall 1 hour. Usual work in column. On right (left) into line, rear or leading trooper halting, others keeping on and halting successively. Practice on the gallop lead, executing cuts, etc., with whips, beating of drums, rolling around on colts.
25. In hall 1 hour. Work-out at will for a few minutes, first at slow gaits and gradually increasing until finally taking the gallop, on both hands. Serpentines and changing of directions at the trot, sitting down on turns. Rider at head of column individually took inner track, halted and kept horse standing with increased distances until all had halted, then all at will took up the gallop on both hands. Beating of can and use of whips.
    Outside ½ hour for walk and grazing.
26. In hall 1 hour. Work at will. Executed movements by threes, backing a few steps, individually. Mounting and dismounting on both sides, sitting in rear of saddle, handling feet, etc.
    Outside ½ hour, formed in line and executed half turns by slightly increasing the gait on the marching flank.
27. In hall and outside. Same as the 26th.
29. In hall 1 hour. Work at will as usual. Work by platoons with everything to date, with the addition of forming in line and executing movements by fours.
    Outside ½ hour wandering in vicinity of riding hall.
30. In hall. Colts were looked over and classified with a view to determining their disposition for the coming school year.

Breaking Class. April 22 *to* 30, ¾ *hours per day.*

The object of this class is to give the student officer practice in breaking the young colt. These colts are assigned to individuals and will be handled by them during the remainder of the school year. During this time they should teach the horse to work on the longe, to allow himself to be quietly mounted and dismounted, and to bear his rider at the walk and trot.

At the end of the school year these horses go back into the pasture and at the beginning of next year enter the training class, in which their schooling as an officer's charger should be completed. Twenty-eight colts

are in the class, three-fourths of which are thoroughbreds received from the Front Royal Remount Depot, a few are half breds from the Fort Reno Remount Depot, and the remainder are odds and ends which were on hand at the school. The majority of the colts are 3 years of age.

22. In hall ¾ hour. Horses were bridled in stalls with snaffle bridles and led to the hall, around which they were led for a short time, and then halted and an effort made to pat and play with them.
23. In hall. Same as the 22d, with the addition that cavessons were put on in hall and horses started longeing in longeing pen. This work was gone at very easily and only kept up for a short time, with frequent halts, during which horses were played with and patted, and everything done to calm them and gain their confidence.
24. In hall. All horses bridled in stalls, and longes put on in hall. Part longed with pens and part without.
25. In hall. Most of the horses longed without pens.
26. In hall. Same as the 25th, with addition of surcingles being put on.
27. In hall. Same as the 26th.
29. In hall. Same as the 26th.
30. In hall. Colts classified and assigned to the student officers.

Field Officers' Class.

2. Talk on the aims and methods of the Mounted Service School. Explanation of what the Field Officers' course was to be. i. e., résumé of the course of instruction followed by the line officers' class, with the talks and explanations given to this class, putting these into practice as far as circumstances will permit, and the observation of the regular class and its work.
   In hall ¾ hours. Observing the regular class working the first training colts.
   In hall 1½ hours. Riding schooled horses, explanations of mounting and dismounting with the flat saddle, the seat as taught at this school and the reasons for adopting the same, the holding of the reins and the double snaffle bridle, riding at will at the walk and trot. Lecture on the aims and methods of the Farriers and Horseshoers School, by Lieut. Lear. Lecture on the anatomy and physiology of the horse's foot, by Veterinarian Jewell.
3. In hall 1 hour. Riding jumpers at walk and trot. Explanation of how to post at the trot. Explanations of three hands in riding, i. e., the heavy hand, the light hand, and no hand, with suggestions as to how to obtain the light hand and why that one is desired; also explanation of the use of the aids with alternate action.
   In hall 1 hour, observing regular class on schooled horses.
   Outside 1 hour, riding schooled horses and visiting school pastures.
   Lecture on normal horseshoeing, by the chief instructor of horseshoeing.
4. In hall 1 hour. Riding schooled horses at walk, trot and gallop. Explanation of using the aids for gathering the horse and increasing or decreasing the gait.
   Outside 1 hour. Walk and trot for 1½ hours in woods. Also at will jumping about 8 log jumps.
   In hall 1 hour. Observing regular class on jumpers.
   Lecture on conformation and defects, by Veterinarian Plummer.
5. In hall 1 hour, observing work of regular class with first training colts.
   In hall 1 hour. Riding jumpers at walk, trot and gallop. Also work in column at walk and trot, executing by the flanks and first trooper from front to rear, practice in halting and moving to the front.

Outside 1 hour. At walk and trot in Magazine Cañon taking at will most of the jumps.
Lecture on pathological shoeing by the chief instructor in horseshoeing.

6. In hall 1 hour. Riding schooled horses; same work as on 5th with the addition of jumping low bar several times and explanation of the use of the aids for turning to the right or left. Also continuation of the use of the aids for increasing or decreasing the gaits.
Outside 1 hour. On road at walk and trot.
In hall 1 hour. Observing work of regular class on jumpers.
8. In hall ½ hour, observing regular class on first training colts.
In hall 1 hour. Riding jumpers. Work by threes, by flanks, increasing and decreasing the gait. Jumped low bar several times.
In hall ½ hour. Riding schooled horses.
Outside 1 hour. Over hills at walk, trot and long gallop.
Lecture on treatment of diseases, wounds, sprains, use of bacterines, serums, antitoxins, etc., by Veterinarian Plummer.
9. Outside 1 hour. On schooled horses at walk and trot over flats, climbing and descending small slopes.
In hall ½ hour. Observing regular class on schooled horses.
In hall 1 hour. Riding jumpers. Work by threes, flanks, etc. Explanation of why horses should lead with inside legs at the gallop, and the aids to apply to obtain the correct leads. Jumped low bar several times.
Lecture on shoeing for gaits by the Chief Instructor of Horseshoeing.
10. Outside 1½ hours riding schooled horses, over hills at walk, trot and 1½ miles at gallop. Jumped several jumps in Magazine Cañon.
In hall 1 hour. Riding jumpers. Work at will and by threes in changing gaits and moving by the flanks. Individual practice in taking the correct lead at the gallop. Continuation of talk on taking the lead at the gallop.
In hall ½ hour. Observing regular class on jumpers.
Lecture on animal hygiene by Veterinarian Jewell.
11. In hall ½ hour. Observing regular class on first training colts.
Outside 1½ hours. On schooled horses for walk and trot over hills, and over pasture jumps and jumps in Magazine Cañon.
In hall 1 hour. Riding jumpers, work at will, changing gaits, by the flanks, and backing. Explanation and demonstration of the aids used in backing.
Examination of normal shoeing, pathological shoeing, and shoeing for gaits, at the School Shoeing Shop.
12. Outside 1½ hours. Riding schooled horses at walk, trot, and gallop on the flats and over hills.
In hall ½ hour. Observing regular class on schooled horses.
In hall 1 hour. Riding jumpers, same as the 11th with the addition of jumping two jumps about eight times each. Also explanation of the indication to the rider as to which lead the horse has at the gallop.
Lecture on watering, feeding, and forage, by Veterinarian Plummer.
13. Outside 2¼ hours. Riding schooled horses 14 miles on roads and over hills at walk, trot, and good gallop.
In hall ¾ hours. Observing regular class on jumpers.
15. In hall ½ hour. Observing regular class on first training colts.
In hall 1 hour. Riding jumpers, usual work at will and by threes.
Special attention to the application of the aids in taking the walk from the gallop.
In hall ½ hour. Riding schooled horses at will.
Outside 1 hour. Riding on island at walk, trot, and gallop at will.
Practical work, conformation and defects, at School Veterinary Hospital.

16. In hall ½ hour. Observing regular class with schooled horses.
In hall 1 hour. Riding schooled horses. Work at will, by threes, by the flanks, halting, backing, taking gallop right or left, taking the extended gallop.
Outside 1½ hours. Riding jumpers. On Island, trot for two miles, individual jumping over logs and rail jumps, about 10 jumps taken. Rest of time at walk.
Explanation of shoeing at School Shoeing Shop.

17. Outside 1½ hours. Riding schooled horses about 7½ miles across country at walk and trot; 1½ miles at a gallop on flats over three jumps.
In hall ¾ hour. On jumpers; same as the 16th.
In hall ½ hour. Observing regular class on jumpers.
Practical work on conformation and defects at the school Veterinary Hospital.

18. In hall ½ hour. Observing the regular class on first training colts.
Outside 1½ hours. Riding schooled horses at walk, trot, and 1½ miles at gallop across difficult country.
In hall 1 hour. Riding jumpers; same as the 16th with the addition of practice in rising to the trot with no reins and hands resting on thighs.
Examination of shoeing at the School Shoeing Shop.

19. Outside 1½ hours. On schooled horses. Over hills, two periods of trot 12 minutes each, and one of gallop for 6 minutes across ditches, etc.
In hall ½ hour. Observing regular class on schooled horses.
In hall 1 hour. Riding jumpers at usual work and jumping two 3-ft. jumps several times.
Talk on breeding, breeds and blood lines by Lieutenant Danford.

20. Outside 2 hours. On schooled horses for walk, trot, and gallop across country. In hall ½ hour, talk and demonstration on the objects and use of the cavesson and longe.
In hall ½ hour. Observing regular class on jumpers.

22. In hall 1½ hours. Riding jumpers in usual school work.
Outside 2 hours. Riding schooled horses across country at walk, trot, and gallop, and on Island jumping various jumps for ½ hour.
In hall. Observing regular class with first day's work with breaking colts.

23. In hall. 1½ hours on schooled horses. Usual work by threes, flanks, etc. Special attention paid to individual work of executing turns on the forehand, backing, taking the trot and gallop at designated points.
In hall ¾ hours. Observing regular class with breaking colts.
Outside 2 hours. On jumpers, riding about 8 miles for the purpose of observing the ride of the officers of the 6th Field Artillery, headed by the colonel, going over a 4-mile course with six jumps in 11 minutes 24 seconds.

24. In hall 1 hour. Observing regular class on second training colts.
Outside 2 hours. Riding schooled horses. Long walk, 2½ miles at trot. Individual galloping ¼ mile each, first quarter at will, second quarter at rate of 20 miles per hour, third quarter at rate of 12 miles per hour. Also two officers setting gait for class at 8-mile trot for one-half mile each.
In hall 1 hour. Riding jumpers. Usual work by threes, flanks, halting, backing, and taking gallop, both in units and individually at designated points. Jumping 3-ft. jumps at gallop, 6 jumps each.

25. In hall 1 hour. Talk on the bit and bridoon bridle, adjustment of the bits, action of same, also various methods of holding the reins with the advantages and disadvantages of each. Also talk on different seats in jumping, with advantages and disadvantages of each.

Outside 1 hour. Riding jumpers. 1 mile at trot, 1 mile at gallop, then jumping individually 10 jumps, 3 of which were post and rail 4 ft. high.
In hall 1 hour. Observing regular class with breaking colts.
In hall 1 hour. Riding schooled horses; usual work in column and a good deal of work at will practicing everything gone over to date. Explanation of the two methods of teaching a young horse to take the gallop, giving the advantages and disadvantages of each. Also a talk on the necessity of keeping a walk when leaving the stable, this due to the lack of circulation in the horse's foot when standing still.

26. In hall 1 hour. Riding schooled horses. Usual work to date. A little work at haunches right (left).
Outside 2½ hours. On jumpers, about 9 miles at walk and trot and 1 mile at gallop, individually jumping 6 obstacles.
In hall 1 hour for observing regular class with breaking colts and schooled horses.
27. Outside 2¼ hours. On schooled horses, 13 miles across country and practice at gaiting. Class led by four different members.
In hall ¾ hours. Observing regular class on jumpers.
29. In hall 1 hour. Riding jumpers. Usual work to date, also jumping individually post and rail several times, first at 3 ft. 6 in., then 3 ft. 10 in.
Outside 2 hours. Riding schooled horses at walk, trot, and gallop across hills.
30. Outside 3 hours riding schooled horses. Attended muster and review of the garrison, on Ogden Flats about 4 miles from the post. All members of the school class were required to attend as part of the garrison.

MAY.

Training Class. May 1 *to May* 31—*about* 1½ *hours per day.*

1. In hall 1 hour. Work at will. Individually, haunches right (left), shoulder in (out), haunches in (out), change of lead on diagonal.
Outside 1 hour. Trot and canter.
2. Outside 1¼ hours. Road work and gallop ¾ mile at 18 miles per hour over Republican Flats brush course.
3. In hall 1 hour. Same as 1st.
4. Outside 1 hour. Road work, cross country and ¾ mile straight away at pace of 20 miles per hour.
6. In hall ¾ hour. Work at will; storm interrupted outside work.
7. Outside 1 hour. Road work and schooling over Magazine Cañon jumps.
8. Outside 1½ hours. Road and cross country work. Took colts to firing point on target range while troops were firing.
In hall ½ hour. Individually on left hand "shoulder in," "haunches right" and "haunches out," direct. Change of lead.
9. Same as the 8th.
10. In hall 1 hour. Work at will. Individually (1) slow trot, halt, back, trot out; (2), slow trot, halt, turn on haunches to right about; (3), slow trot, turn on haunches and back to the track on two tracks.
11. In hall 1¾ hours. Work at will. Individually, change of leads, both hands, taking jumps without wings in center of the hall.
13. Outside 1¼ hours. Road work, and 1½ miles at 15 miles per hour.
14. In hall 1½ hours. Work at will, figure of eight on the haunches.
15. Outside 1½ hours. Road work, gallop 1 mile at 22 miles per hour. Jumping in Sheridan woods.
16. Outside 2 hours. To Ogden Flats, and galloped over the jumps set for 6th Field Artillery "Russian Ride."

17. In hall 1 hour. Worked at will, drill at canter, jumping without wings.
18. Outside 1 hour. Gallop over jumps in Sheridan woods.
20. Outside 1 hour. Trot and long canter.
    In hall ¾ hour. Work at will, individually, figure of eight on the haunches, change of leads.
21. Outside 1½ hours. Gallop 2½ miles at 17 miles per hour over jumps set for 13th Cavalry "Russian Ride."
22. Outside 1½ hours. Training on race track field. Repeating hall exercises in the open.
23. In hall ½ hour. Training at will. Outside ½ hour over a few jumps in Sheridan woods.
24. In hall 1 hour. Individually, shoulder in on both hands, and figure of eight on the haunches.
25. In hall 1 hour. Drill by platoons and jumping without wings.
27. Outside 1½ hours. Schooling over ditch jumps, and training exercise on Race Track field.
28. Same as 27th, only schooled over jumps in woods.
29. At race track. Scoring for Stockholm team in try-out over the course.
31. In hall 1 hour. Training at will. Individually figure of eight on haunches and change of leads.

School Class. May 1st to May 31st—about 1½ hours per day, Saturdays excepted.

1. In hall 1¾ hours. Worked at will at trot, then everybody at same time at the slow trot; worked successively on circles, straight lines, haunches in (both hands), two tracks, shoulder in (both hands), gallop leads alternated at short intervals. Worked by platoon, changing lead at gallop by trooper and by fours in center of hall. Jumped 3ft. 6 in. hurdle several times. Grazed about five minutes.
2. In hall 1¾ hours. Review, same as 1st.
3. Outside 2 hours. Rode in woods at walk, trot and gallop, taking small jumps; rode down over Republican Flats and jumped one ditch, one log, one rail, one rail and ditch and two brush jumps, grazed twenty minutes.
6. In hall 1 hour. Work-out five minutes; worked by trooper and by threes on circles, straight lines, haunches in, shoulder in, two tracks, on forehand to right and left and backing.
7. Outside 2 hours. Jumped several log hurdles in woods, and two ditch jumps near race track, galloped over flats to target range and back to polo field; walked to post and grazed for twenty minutes.
8. In hall ½ hour. Executed by flanks, circles, halts, backing, on forehand to right and left, change of lead at end of diagonal; practiced taking the gallop on straight lines from the slow trot. Outside ¾ hours. Rode at walk over soft and slippery ground, jumped two ditches in vicinity of race track; also one log and one pole jump.
9. In hall 1¼ hours. Worked by threes executing by flanks, circles, halting, backing, turning on forehand to right and left; rode at gallop around hall to rear of column, executed first trooper from front to rear; rode over two brush hurdles several times.
10. In hall 1½ hours. Went through the various exercises and took two jumps, one three feet eight inches high and one four feet high. Outside ½ hour for walk and grazing.
13. In hall 1 hour. Work-out for 10 minutes on both hands at walk and trot. Executed by platoon, individual abouts on haunches, by the flanks, halts, changes of gaits, serpentines, spirals and backing. Reins were held in one hand only part of the hour.

14. Took pictures of class at school work. In hall ½ hour jumping hurdles 3 ft. 8 in. high.
15. In hall ½ hour. Worked at walk, trot and gallop on track, serpentines, abouts, circles, halts and backing. Outside ¾ hours. Rode in woods and took log and pole jumps.
16. Same as 15th except that some jumping was done in hall by dropping the reins when making the leap.
17. Outside 2 hours. Horses were sent in pairs for walk, trot and canter; some jumping over small hurdles, and grazing.
20. In hall 1 hour. Collected work, including haunches in, shoulder in and two tracks. Jumped one hurdle 3 ft. high several times.
21. In hall 1 hour. Practiced collecting, flexing and backing; galloping by flanks, riding on circles and halting. Jumped hurdle 3 ft. high several times.
    Outside 1 hour. Galloped over ditches, walked up and down slopes and grazed.
22. In hall ½ hour. Same as 21st except no jumping.
    Outside ¾ hours. Work the same as for the 21st.
23. Ride for Senior Class, Kansas State Agricultural School.
24. Outside 2 hours. Rode in woods, took log jumps and two rail jumps 3 ft. 6 in. high; also jumped two ditches and the water jump near Race Track. Walked on road and did some collected work on sod.
27. In hall 1 hour. Work-out and riding at will doing collected work.
    Rehearsed "forehand in," "shoulder in," backing and "two tracks."
28. Outside 1 hour. Trotted about two miles in woods and several miles over hills.
    In hall 1 hour. Worked at collecting, balancing and shortening stride. Took 3 ft. 8 in. jump several times. Rehearsed putting on curb bridle (training colt), the first time; holding reins (three methods and their variations), and feeding.
29. Schooled horses not used; student officers witnessed and scored riding of the Olympic Team held on race track.
31. Outside 2 hours. Jumped several hurdles in Magazine Cafion; went for long trot and walk.

Jumping Class.

1. On road, walk, trot and gallop.
2. Same as 1st.
3. Short drag hunt with fox hounds.
4. In hall, field officers' class observing. Suppling exercises for horses; jumping 5 jumps 3 ft. high 20 ft. apart, first time over with reins and stirrups, second time no reins, arms folded, third time no reins or stirrups, hands on thighs.
6. On road, quiet walk in pairs.
7. Drag hunt.
8. On road, walk and slow trot.
9. In hall. Suppling exercises at will; jumping 2 bar jumps 3 ft. 9 in. on track taken twice at gallop.
10. Drag hunt.
11. In hall. Jumping, bars 3 ft. 9 in., stone wall 4 ft., over twice at gallop.
13. Outside. Walk and trot on road; twice over 4 ft. post and rail.
14. Drag hunt.
15. Went over horses, estimating heights and weights, examining also as to soundness and conformation weaknesses. On road, walk and trot.
16. Same as for 15th.
17. Drag hunt.
18. In hall. Over in and out 3 ft. 6 in. and 3 ft. 5 in. also 4 ft. and 3 ft. 9 in.; then pig pen 3 ft. 6 in., 3 ft. 5 in., 3 ft. 9 in.

20. In hall. Jumping, bars 3 ft. 9 in. and 4 ft. and stone wall 3 ft. 6 in. and 4 ft.
21. Drag hunt.
22. Outside. Jumping post and rail 4 ft. over, turn and back over.
23. In hall. Exhibition for Kansas State Agricultural College students. Jumping same as 4th. Also 4 ft. rail jump and 4 ft. stone wall.
24. Drag hunt.
25. In hall. Over 4 ft. rail on one side, then around the turn and change hands, and on other hand over 4 ft. stone wall, all at the gallop, only one rider in the hall at a time.
27. In hall. Jumping, bars 4 ft. and 4 ft. 3 in. Members of class called on for criticisms of each other.
28. Drag hunt.
29. No work, horses led 45 minutes by stable men.
31. In hall ¾ hours. Over various jumps, then on road at will 2 hours.

Second Training Class. May 1*st to* 31*st—About* 1½ *hours per day.*

1. Outside 1 hour. Rode at a walk through ravines, up and down slopes and over soft (spongy and heavy) ground.
   In hall 1 hour. Few minutes' work-out at the trot, then everybody at will, worked successively on small circles, straight lines, haunches right and left on track to interior, halting, backing, and work by threes. Handled and gentled colts by dismounting and mounting on both sides, leaning shoulders on horse's rump, sitting in rear of saddle, lifting feet, etc.
2. Outside 1 hour and in hall 1 hour. Review, same as 1st.
3. In hall 1 hour. Work-out for ten minutes on both hands at walk and trot; review same as 1st.
4. In hall 1 hour. Work out for ten minutes at trot and slow trot. Same as work in hall on 1st with lateral flexions at walk and trot added; also extended gallop on both hands.
6. Inside 1 hour. Work-out for ten minutes at walk and trot. At will and by platoon, executed circles, haunches right and left (on track), rode on straight lines, by the flanks, turned on forehand, backed, halted from slow trot, galloped with extended distances.
7. In hall 1½ hours. Work-out for ten minutes. Worked at slow trot, trot and gallop. Executed abouts, haunches right and left, halts, changes of gaits. Outside for ten minutes to graze.
8. In hall 1 hour. Worked at will for ten minutes on both hands at the trot. Executed circles, serpentines, halts, lateral flexions. Advance, mild set of "haunches in" starting in corner, two tracks in column for one horse's length to track along wall and haunches right and left, first to outside then to inside of large circle while passing a given point.
   Rehearsed half turn in reverse, haunches right (left), and "on two tracks."
9. In hall 1 hour. Review same as 8th. Outside ½ hour for walk and grazing.
10. In hall 1 hour and outside 1 hour. Review, same as 8th.
11. In hall 1½ hours. Work-out for ten minutes. Executed circles, half turns in reverse, by the flanks, halts from slow trot and trot, serpentines, spirals; executed first trooper from front to rear towards the interior of hall, halted on inner track with horse at attention for a moment then at rest with reins full length; all troopers in rear did likewise, halting from twenty to thirty feet in rear of preceding trooper; all moved obliquely to track and took true gallop at will. Gentled colts; had close order drill by fours in line and column.

13. Outside 1½ hours. Exercised in woods at walk and trot on road, through bushes, up and down slopes, and over soft spongy ground. Drilled by fours in line and column and jumped ditch several times near race track; grazed for a few minutes. Colts are improving greatly in strength and handiness.
14. Inside 1 hour. Work-out for ten minutes. Went through the various exercises, including two tracks. Led over bar on ground at end of reins, then with bar on standards about one foot high, then repeated same with rider up.
    Outside ½ hour. Executed movements in line and in column of fours, and grazed.
15. In hall 1 hour. Practiced collected walk, flexions, trot with some collection, gallop with mild use of diagonal aids; circles, abouts, halts. Outside 1 hour. Rode over ditches, up and down slopes through woods; had close order drill in line and column of fours, and grazed.
16. Outside 1½ hours. Rode over rough ground, over ditches, up and down slopes and through ravines.
17. In hall ¾ hour. Collected work, individually and by platoon—no galloping. Outside ¾ hour. Rode at gallop over ditches, up and down slopes; rode at walk through woods, grazed for a few minutes.
20. In hall ½ hour. Worked by platoon at walk and slow trot, collecting and flexing. Outside 1 hour. Rode over rough ground, logs and ditches and through woods. Had close order drill in line and column of twos and fours.
21. In hall ½ hour. Executed circles, abouts, halts, backing, by flanks; first trooper from front to rear, practiced leaving column and halting, keeping horse quiet and at rest; rode over very small jump. Outside 1 hour. Review, same as 20th.
22. Outside 1¼ hours. Rode in woods and jumped several small hurdles; also jumped ditches near race track and one brush hurdle on Republican Flats. In hall ¾ hours. Review, same as 21st.
23. In hall 1 hour. Same as 22d. Outside ¾ hours. Review same as 22d.
24. In hall 1½ hours. Executed circles, half turns on forehand, haunches right (left), backing; jumped one hurdle about two feet high, several times.
25. In hall ¾ hours. Review, some as 24th. Outside ¼ hour. Review, same as 24th.
27. Outside 1¼ hours. Jumped log jumps in woods and ditch jumps on Republican Flats; walked, trotted and galloped over grassy places; grazed.
28. In hall 1¼ hours. Work-out at will; executed circles, haunches right (left), lateral flexions, backing, gallop on both hands. Outside ¼ hour grazing.
29. In hall 1 hour. Practiced collected work, flexions, backing, haunches right (left), gallop with both leads. Outside ½ hour; walked and grazed.
31. In hall 1 hour. Review, same as 29th. Outside ½ hour. Jumped hurdles in woods.

Breaking Class. May 1*st to* 31*st—about ¾ hours per day.*

1. In hall ¾ hour. Longed, handled feet, put on surcingles.
2. Same as 1st.
3. Same as 1st, and in addition laid on saddles.
4. In hall 1 hour. Longed with and without saddles, let down stirrups and mounted.
6. In hall ½ hour. Longed, handled and mounted.
7. In hall 1 hour. Same as 4th, and in addition rode on both hands at a walk.

8. Same as 7th.
9. Same as 7th, increasing time at walk to 15 minutes.
10. Longed 30 minutes and led to scales to be weighed.
11. In hall 1 hour. Longed, rode at walk and jog trot on both hands.
13. In hall 1 hour. Longed, rode at walk and jog trot on both hands.
14. Same as 13th, increasing time at jog trot and at will at walk.
15. Same as 13th, and in addition extending trot and rising to the trot.
16. In hall 1 hour. Longed a few minutes, mounted and rode at walk, jog trot and trot out. At jog trot, circles and serpentines in column, crossing the hall and riding at will.
17. Same as 16th.
18. Same as 16th, and in addition dismounted, whip exercises.
20. Same as 18th.
21. Same as 18th, only decreasing the longing and increasing the time under the saddle.
22. Same as 21st, increasing the work at will and using lateral aids.
23. Same as 21st and in addition canter on both hands.
24. In hall 1 hour. Walk, trot, canter, in column, circles, change of direction, change hands, first trooper front to rear and last trooper rear to front, changes of pace, spirals, etc.; dismounted whip work.
25. Same as 24th.
27. Same as 24th.
28. Same as 24th.
29. Longed a few minutes in the hall, and outside for road work for rest of the hour.
31. Same as 29th.

Field Officers Class.

1. In hall 1 hour, riding schooled horses. Work at will and in column changing gaits, movement by the flanks, etc. Individual practice at haunches right (left). Outside 1 hour. At walk, and jumping eight obstacles; also observed two periods of polo game.
2. Outside 1½ hours, riding jumpers. Walk and trot for three miles. Class then divided into pairs with several hundred yards distance and sent two miles at trot and gallop over Magazine Cañon jumps.
   In hall 1 hour. Riding schooled horses. All work to date, and work by threes at the gallop with movements by the flank and abouts. Work at will with everything to date. Explanation and demonstration of the mechanism of the gallop. Also talk on the two methods of teaching a horse to take the gallop, and the advantages and disadvantages of each.
3. Outside 2 hours, riding schooled horses. About 10 miles on road and across country. Class led 1½ miles at gallop by a member through woods and over ravines. Class led by instructor about ¾ miles over hills at very fast gallop. Also jumped several ditches at ordinary gallop. In hall 1 hour riding jumpers. Work at will and in column and by threes. Jumped several times 3 ft. in and out, and over 3 ft. jumps without wings, this at a gallop.
4. Outside 2 hours, riding schooled horses. Line of jumps on Republican Flats taken at gallop. About six miles at walk and trot on road and across hills. Class led by a member for 1½ miles at gallop over hills, about 20 miles per hour. In hall 1 hour. Observing regular class on jumpers.
6. In hall 1½ hours, riding jumpers. Usual work in column and by threes with special practice at holding the reins in one hand, either right or left. Continuation of talk on the mechanism and how to obtain the lead at the gallop.
   Outside 1½ hours, riding schooled horses, rode in pairs at will.

7. Outside 1¾ hours, riding jumpers. Over hills principally, at walk and trot. Jumped several ditches and followed hounds for a short time.
   In hall 1 hour, riding schooled horses. Usual work in column and by threes. Practice change of lead at the gallop. Jumped several 3 ft. jumps.
8. In hall ½ hour, observing regular class riding schooled horses. Outside 1¾ hours riding schooled horses at walk and trot across hills, and one mile gallop over Republican Flat jumps; 1 hour riding jumpers on the Island, jumping about nine jumps from 3 ft. 6 in. to 4 ft. in height. Talk on and practical demonstration of grooming.
9. In hall 2 hours, riding jumpers. Usual work by threes, etc., and jumping individually and in pairs. Practical illustration and exhibition of bandages, exercise, stable, cotton pads, felt pads and compresses.
10. Outside 2 hours, riding schooled horses over hills at walk, trot and gallop, one of the latter being one mile in 2 min. 15 sec. Class led by a member endeavoring to set a pace of one mile in three minutes.
    In hall ¾ hour, riding jumpers. Work at will in column and by threes at walk, trot and gallop. Jumped individually several times at the gallop, 3 ft. 9 in. white fence, and 3 ft. 6 in. in and out. Care of feed in garrison and field, under various conditions of climate and soil.
11. In hall 2 hours, riding jumpers. Work with the regular class riding schooled horses. Usual work by threes, in column, by the flanks, changing the gaits. Jumped in pairs composed of one regular student officer and one field officer.
13. In hall 1½ hours, riding jumpers. Usual work by threes and at will. Special attention given to individual riders making figure of eight at a trot around stake. Also riding on circles at a gallop around stakes. Jumped four times around course of 3 ft. 9 in. fence, and 3 ft. in and out.
    Outside ¾ hour, riding schooled horses. 12 miles across country at walk, trot and gallop, coming home over Republican Flats jumps in pairs at a gallop. Doing two stretches of gallop of ½ mile each, a member of the class set the gait for a rate of 20 miles per hour. Stable construction and fittings; soil, foundation, arrangement of stalls, material for roof, floors and paving, stalls (box and open).
14. Outside 2 hours riding jumpers over hills at walk, trot, and one mile in two minutes and 40 seconds at the gallop. Returned over pasture fence jump, jumps being from 4 ft. to 4 ft. 3 in. in height.
    In hall 1 hour, riding schooled horses. Usual work, with special attention given to individual horse on circle at a gallop. Short explanation of and practice at "on two tracks right (left) oblique." Stables, construction of, ventilation, benefits of good air, drafts and chills, proper temperature, means of ventilation, drainage, stable fittings, doors, latches, windows, partitions, kicking boards, mangers, hay racks.
15. In hall ½ hour, observing regular class riding schooled horses. Outside 1½ hours, riding schooled horses over hills at walk, trot and gallop. Leading by members of the class. Jumped Magazine Cañon jumps.
    In hall 1 hour. Work-out, then practice by individuals taking gallop and changing lead. Jumped twice 3 jumps 20 ft. long and placed 40 ft. apart; this for practice in applying aids to keep horses from running around end of jumps or refusing. Jumps were without wings. Grooming, theory of grooming, tools and care of same, washing horses, clipping, how same should be done, with advantages and disadvantages.
16. Outside 2¾ hours, riding jumpers. Most of the time was on Republican Flats at walk, trot and short gallop. Returning, jumped brush jump and two ditches.
    In hall one hour, riding schooled horses. Work-out, usual work threes, etc., work at will. Individually on right hand, haunches right (left),

"on two tracks right (left) oblique," change of lead on diagonal at the gallop.

In hall ½ hour, observing regular class riding first training colts. Clothing, use and abuse of same, arguments for and against use on field service, patterns and fits, cleaning, bandages, materials of which made and care. Securing a horse in stable and various methods.

17. Outside ¾ hour, riding schooled horses. Walk, trot and gallop over hills with one short and one rather long run across country after jack rabbit.

In hall 1 hour, riding jumpers. Work-out, work at will and usual work by threes and in column. Practice at changing the lead on the diagonal at the gallop. Jumped twice around at the gallop, one 3 ft. in and out, and one 3 ft. fence, all without wings. Bedding, various kinds and care; stable tricks and vices, causes and methods to cure or prevent.

18. Outside 2 hours, riding schooled horses over hills for 15 miles, 13 of which was in 1 hour and 45 minutes.

In hall ½ hour, observing regular class riding jumpers.

20. In hall ½ hour, riding jumpers. Work at will and by threes. Outside on Island 1 hour. One mile at gallop and then individually jumping about 12 jumps from 3 ft. 6 in. to 4 ft. in height.

Outside 2 hours, riding schooled horses at walk and trot across country. Class also led for cross-country gallop by a member, jumping several ditches during ride.

In hall ¾ hour, observing regular class on jumpers and breaking colts. Routine of stables. Condition and exercise, racing condition, hunters' condition, value of condition in war, dealers' condition, method to secure condition, exercise and feeding. Practical illustration of mane and tail dressing for thoroughbreds, hunters, and hacks. Doing up tails for muddy weather.

21. Outside 2 hours, riding jumpers at walk and trot, with gaiting at trot by members of the class. Jumped in pairs the Magazine Cañon course.

In hall 1 hour riding schooled horses. Work at will and by threes. Special attention to changing of lead at the gallop, on two tracks right (left) oblique, taking the canter from the back, halting and turning on the forehand at designated points. Management of horses on the march and in field service. Practical illustration of braiding the mane in the ordinary manner, and the running braid with rosettes.

22. Outside 1¾ hours, riding schooled horses across hills at walk, trot and gallop. Returned at gallop over Republican Flat jumps. In hall ½ hour, observing regular class riding schooled horses.

In hall 1 hour, riding jumpers. Long work by threes at all gaits, specially the gallop. Jumped five times three 3 ft. jumps placed 28 ft. apart. This at the gallop with reins hanging very loose, finally without stirrups, and a portion of the class with neither stirrups nor reins. Exhibition of various means of protecting a horse while jumping and traveling,—cannon boots, shin boots, knee boots, quarter boots, hock boots, and tail guards. Exhibition of pulling manes and tails.

23. Outside 1½ hours, riding jumpers at walk and trot. Jumped several ditches, one rail fence and liverpool.

In hall 1 hour, riding schooled horses. Short work-out and work by threes. Explanation of proper manner of carrying and using the riding whip.

24. Outside 1¾ hours, riding schooled horses at the walk and trot over hills, returning via Republican Flats over jumps at a gallop for one mile.

In hall 1 hour, riding jumpers. Usual work-out and work by threes. Also jumped various jumps, including 4 ft. stone wall.

In hall ¾ hours, observing regular class with breaking colts.

25. Outside 2½ hours, riding schooled horses. Walk, trot, and gallop across hills and up and down steep banks. Leading at 8 miles an hour trot by members of the class.
In hall 1 hour, observing work of regular class riding jumpers.
27. In hall 1½ hours, riding jumpers. Long and hard schooling of work of the complete course riding with reins in one hand. This included changing of gaits, halting, backing, turning on the forehand, changing lead at the gallop, and riding around stakes on circles and figures of eight at the trot and gallop. Also jumping various jumps without wings, the jumps being scattered around the hall. Outside 1 hour riding schooled horses. Jumping various obstacles on the Island. About 14 jumps in all taken, averaging 3 ft. 6 in. in height. Inside 2 hours. Talk by senior instructor regarding the work of the school in general, what should be expected of its graduates, and the application of the principles taught at the school to the service at large.
28. Outside 2½ hours, riding jumpers for about 6 miles, and taking photographs of the class jumping the Magazine Cañon obstacles.
In hall ½ hour, riding schooled horses, usual schooling work, most of the class riding the McClellan saddle.
29. Outside 2½ hours, observing work of the Olympic team in a tryout over the regular jumping course of principal obstacles, and also in a half mile gallop over the steeplechase course of four jumps, the half mile being made by most horses in one minute ten seconds.
31. Outside 2 hours, riding schooled horses. A short drag hunt with foxhounds of about two miles over the hills. Following this, the taking of a photograph of members of the class over the regular jumps of the Magazine Cañon course. This day's work completed the course of the Field Officers' Class.

JUNE.

Training Class. June 1 *to June* 15*th—about* 1½ *hours per day.*

1. Outside 1 hour. Road work, canter, and ¾ mile gallop at 20 miles per hour.
3. Outside 1½ hours. Put on bit and bridoon, with curb chains very slack. Easy road work to accustom horses to the bitting. Light training work.
4. In hall 1½ hours. Testing colts individually through all the exercises.
5. In hall 1½ hours. Test of training and jumping. Jumps 3 ft. 8 in.
6. Outside 1 hour. Road work and gallop.
In hall. Tests on training and jumping.
7. Same as 6th.
8. Lecture by Senior Instructor instead of usual ride.

10-13. Training for graduation ride, one and one-half hours per day.

14. Graduation Ride. The ride of this class was intended to show the steps in the training of a charger, taking it up from where the Breaking Class left off and continuing to where the Schooled horses took it on. The following exercises were shown: individual circles, on forehand, half turn in reverse, changes of gaits, halt from each of the regulation gaits, and taking each gait from a halt, drill by threes showing turns to right and left about on forehand and on the haunches, haunches right and left, two tracks right and left oblique at school trot, gallop in column with change of lead on changing hands; individually each rider executed a figure of eight at a canter with two changes of lead; in column, halt in line from a gallop, swinging from the track by the flank. For the jumping exhibition four jumps were set, two small fences and two bar jumps 3 ft. 10 in. The rider took the track on the left hand and after the second jump changed hands and changed

leads and took the next two on the right hand. The two larger jumps were faced to the main gallery. The colts were required to maintain an even canter all the way.

School Class. June 1 *to June* 15*th—about* 1 *hour per day*.

3. In hall 1 hour. Executed the exercises with a good deal of collection demanded. Jumped one 3-foot hurdle several times.
4. In hall 1 hour. Review, same as 3d. Outside 1 hour for walk and grazing.
5-13. Practiced for the Graduating Ride. After forming on track, on right hand at the trot, the movements were as follows: (a) large circle and spiral; (b) haunches in and shoulder in (at slow trot); (c) by left flank, backward, forward, slow trot and by right flank; (d) with right lead canter, by threes, by right flank, backward, forward, and with the left lead canter, track to left; (e) on haunches, individual circles; (f) by threes by left flank, left oblique, change lead and take track to right; (g) counter gallop (canter); (h) slow trot, canter, change hand and change lead in center of hall; (i) by trooper on two tracks to center and change, change lead again at track; (j) all walk except leader of first platoon, individual change of lead; (k) canter with distances between threes extended, threes column left and form three circles, take track and slow trot at head; (l) canter, platoons column left and form circle and cross; (m) three concentric circles, the center and outer circles moving on right hand and the inner circle on left hand, last three of second platoon execute troopers left about at trot, all of first platoon execute on haunches troopers right about at trot, then on haunches left about at center, column of twos was formed at trot, class passed out of hall and changed from double to single (snaffle) bridles.

   After the previous exercises and after the hurdles had been placed in the hall (three in number, each 3 ft. 8 in. high, two on the track and one in the center of the hall on the diagonal) the riders returned one at a time at signal and rode once over the course.
14. Graduating ride as outlined above.

Jumping Class.

1. In hall. Twice over 4 ft. bars and 4 ft. stone wall, rapping bar used. Outside. Road work.
3. In hall. Twice over 4 ft. bars, rapping bar used.
4. Over Magazine Cafion course in pairs.
5. Led on road one hour.
6. Road work.
7. Try out over Liverpool jumps.
8. Lecture by Senior Instructor.
10. In hall. Try out over course for final ride.
11. Try out over the jumps on steeplechase course, one jump at a time.
12-13. Try out over the indoor course.
14. Graduation ride, indoors, over the following course: bars 4 ft., triple bar 4 ft., railroad crossing 3 ft. 9 in. and stone wall 4 ft. 3 in. Also taking three fences 15 feet apart with arms folded and without reins.
15. Graduation ride, out of doors. This ride was held at the race track over a series of four jumps such as are usually found on steeplechase courses of this country, and built according to the specifications, consisting of a water jump, a board fence 4 ft. 3 in., a hedge and a Liverpool. The riders took the course one at a time and rode at a three minute pace or better. These two rides were intended to present such

obstacles to the riders as they would be liable to encounter in mounted competitions, whether in the show ring, on the steeplechase course, or between the flags of a cross country run.

Second Training Class.

1. In open-air hall, 55 minutes. Work out at will for five minutes. Executed circles, abouts, half turns in reverse, haunches right and left, backing, flexions and gallop individually on both hands. Grazed five minutes.
3. In hall ½ hour. Worked at will at walk and trot for ten minutes. Executed flexions (lateral and direct), circles, spirals, serpentines, and changes of direction at will. Outside. Rode in woods and jumped logs and small rail hurdles; jumped ditches on Republican Flats.
4. In hall 1 hour and outside ½ hour. Review, same as 3d.
5. Attended exhibition ride by Olympic team on race track grounds.
6. Turned out to pasture.

Breaking Class.

1. In hall. Longed, rode at walk, trot and canter. Drill at jog trot, canter, change of direction, serpentines. Outside for half hour at walk.
3. Same as 1st, and in addition dismounted flexion and training with whip.
4. Outside for road work.
5. 6 and 7. Same as 4th.

8-13. Preparation for final ride.

14. Graduation Ride. On the track, moving to the front, first at a walk then at a trot; large circles and spiral at trot, then gallop on large circle; trot, serpentine, and take gallop on large circle on opposite hand; take track at gallop, trot, by flank, walk and halt; all work at will for a few minutes at walk then at trot, executing change of direction, abouts and circles and riding on straight lines.

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.)

June, 1912.

A Comparison of British, French and German Methods of Employment of Artillery in the Field.—Capt. H. W. Wynter, R. F. A.

"Duncan" Gold Medal Essay, 1912. The main point of the paper is in its application of all the arguments to the British system, which differs radically from ours; but there are good expositions of the essential differences between French and German strategy, and of the different systems of artillery tactics.

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

Reply to an article in the December number (see FIELD ARTILLERY JOURNAL for March). The writer is an advocate of covered positions wherever possible, and states his arguments for them vigorously. At the end of his paper he urges that, at service practice, fire for effect at infantry trenches should often be illustrated, the necessary ammunition being saved by abolishing fire for "classification" of the batteries. His point is that this would give both artillery and infantry officers a clear idea of what an infantry position under fire looks like, and help the infantry to realize that the artillery need not be in their skirmish lines.—that "its support is to be looked for at the target end of the range, not at the muzzle end."

Recent Years in South Africa.—March Brown.

An optimistic review of the last few years progress,—social, industrial and political.

Japanese Horsemanship.—Capt. G. N. Wyatt, R. A.

Impressions of a three-day, fifty-mile march with a Japanese field artillery regiment. The Japanese methods are altogether different from those of the Occidental, but the writer seems to think that they are well suited to the horses, men and conditions, and that the Japanese is not to be despised as a horsemaster.

The Battery Signaller.—Maj. W. Ellershaw, R. A.

The writer believes it unnecessary to give artillery signalmen so complete a training as is now done in the English service; he advocates eliminating certain subjects of instruction and devoting more time to others.

Memorial de Artilleria.—Extracts from the March number, translated by Maj. Gen. J. C. Dalton.

The Guilléry Aphegraph.—Translation from *Revue d'Artillerie,* Jan., 1912, by Col. A. H. C. Phillpotts, R. A.

Notes on the Armament of the Swiss Artillery.—Translation from *Jahrbücher für die deutsche Armee und Marine*, by Lieut. J. F. deF. Shaw, R. G. A.

L'Artillerie dans la Bataille.—Review of Col. Paloque's book (see FIELD ARTILLERY JOURNAL for June), by Col. R. M. B. F. Kelly, R. A.

Kriegstechnische Zeitschrift.—Precis of contents, Nos. 8 and 9, 1911, by Col. H. A. Bethell, R. A.

July, 1912.

A Comparison of British, French and German Methods of Employment of Artillery in the Field.—Maj. A. T. Anderson, R. F. A.

"Duncan" Silver Medal Essay, 1912. Contains a brief review of the artillery equipment, organization, firing methods and tactical principles of the three countries, and suggestions for the improvement of the British service.

The Field Artillery.—"Collective."

A series of suggestions for the improvement of the British field artillery. The writer argues for panoramic sights, and for a battery instrument cart instead of so many mounted men. He questions gravely whether it is not a mistake to carry only shrapnel in the field batteries; favors careful training of sergeants to act as platoon commanders, on the theory that there will never be enough officers in war; and calls for greater attention to angle of site and height of burst.

The Russo-Japanese War—Employment of Field Artillery from June to October, 1904.—Lieut. R. G. Cherry, R. F. A.

A comparison of the two opposing artilleries, with analysis of their methods. The writer attributes the poor success of the Russian artillery to imperfect control, and to failure to make use of all the guns available.

Motor Transport for Army Purposes.—Capt. R. M. Powell, R. A.

Notes from the *Scientific American*, showing German methods of subsidizing motor vehicles for Army transport.

The Question of the Light Field Howitzer.—Translation from *Journal des Sciences Militaires*, April, 1912.

The Tactics of the Japanese Artillery.—Translation from *Löbell's Jahresberichte*, 1912.

Method of Orienting Cupolas and Armored Turrets.—Translation from *Revue de l'Armée Belge*, Jan.-Feb., 1911.

Artillery on the Field of Battle.—Translation from *Revue de l'Armée Belge*, Jan.-Feb., 1912.

The Attack of a Coast Fortress.—Translation from *Artilleristische Monatshefte*, March, 1912.

Kriegstechnische Zeitschrift.—Precis of contents, Nos. 1, 2 and 3, 1912.

August, 1912.

Comparison of British, French and German Methods of Employment of Artillery in the Field.—Col. H. A. Bethell, R. A.

"Duncan" Commended Essay, 1912. Contains an interesting review of Gen. Percin's ideas, showing to what extent they were officially adopted and how the regulations have since been modified.

Aircraft for Use in War.—Maj. Sir A. Bannerman.

Lecture delivered at the Royal Artillery Institution, Feb. 22, 1912. Describes the various forms of aircraft,—captive balloons, kites, dirigibles and aeroplanes,—and points out how each type may best be used.

Flank Observation from a Low-Site Battery.—Lieut. R. V. Douglas, R. G. A.

Description of a chart system for utilizing range observations from a flank, at coast artillery target practice.

Suggestions for Improvements in R. G. A. Matériel.—Capt. A. F. U. Green, R. A.

Miscellaneous hints for simplification of coast artillery methods. Among them is a proposition to mix various substances with shell fillers, so as to give different colored bursts, and thus enable a battery commander to identify his own shots by selecting a color different from that used by other batteries on the same target. This has been proposed in France for field artillery projectiles, and the idea seems worth considering.

The Strategical Geography of the Near East.—H. J. Mackinder.

A lecture delivered at the Royal Artillery Institution December 14, 1911.

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

The writer takes issue with Lieut. Col. Talbot, whose paper on this subject, published in the May number, is noticed in the FIELD ARTILLERY JOURNAL, for June, on many points. Evidently the horse question is being approached from many directions, in the English Territorial force as in our Militia.

The Communications in a Coast Fortress.—Lieut. S. D. Wilmot, R. G. A.

Discussion of the paper on this subject by Capt. Hutchison, published in the November number, 1911 (see FIELD ARTILLERY JOURNAL for December). The writer distrusts the telephone alone, and favors the buzzer, capable of use as either telegraph or telephone.

The Employment of Aircraft in Coast Warfare.—Translation from *Jahrbücher für die deutsche Armee und Marine*, June, 1912.

Proposed School of Military Aviation for Switserland.—Translation from *Revue Militaire Suisse*, No. 2, 1912.

Dirigibles and Aeroplanes in Germany.—Translation from *Revue Militaire des Armées Etrangères*, May, 1912.

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

May, 1912.

Military Aviation.—Captain Bellenger.

A lecture delivered at the Sorbonne, Feb. 11, 1912. Gives a popular account of what has been and can be done with military aeroplanes, selecting

various situations from the campaign of 1870 in Alsace and showing how aeroplanes would have altered them.

Collective Letter of Inspectors-General of Artillery.

A letter of protest, written in 1822, against a royal ordinance of 1820, making certain changes in administration; considered of some interest now in view of recent French administrative changes.

The Ordnance Corps.

The French find difficulty, under present conditions, in maintaining their Ordnance Corps, which is made up exclusively of artillery officers. The *Revue* plans a series of papers discussing various proposed reorganization plans; this, the first, proposes an entirely new corps, to handle all ordnance construction for both Army and Navy.

Rapid Fire Heavy Field and Siege Guns.

Conclusion of series of papers noticed in the FIELD ARTILLERY JOURNAL for June; describes the Schneider 105 mm. and 150 mm. siege guns.

Dropping Bombs from Aeroplanes.

Description of the bombs used by the Italians in Tripoli. These are said to have been cylindrical, with a heavy spherical head; the weight was 10 kg. The bursting charge, of picric acid, was surrounded by bullets held in a matrix of trinitrotoluol. To avoid rifle fire, the aeroplanes were compelled to maintain an altitude of 1,000 meters; this made the results very uncertain, and also caused many bombs to bury themselves in the ground before exploding.

June, 1912.

Remarks on the 1911 *Maneuvers*.

Taking as a text an extract from the remarks of the Chief of Staff on the 1911 maneuvers, this paper deprecates the tendency of commanding officers to assign their artillery prematurely to subordinate commands, and thus lose control of it themselves.

Contribution to the History of Artillery.—Major Romain.

A study of the peculiar controversy in the early part of the 19th Century, as to the right of French artillery and engineer officers to command in mixed forces.

Study in Artillery Fire.—Capt. E. Pagezy.

Continuation of the paper under this title in the January number (see FIELD ARTILLERY JOURNAL for March). Argues for more general use of positions far behind the mask.

Safety in Aeroplanes.—Maj. P. Lucas-Girardville.

Remarking that aeroplane construction hitherto has depended chiefly upon such experience as could be gained in actual flight, and very little upon scientific tests and calculations, the writer proceeds to describe some recent installations for systematic testing.

Reorganization of the Dutch Field Artillery.—Lieut. Schilderman.

A detailed description by a Dutch field artillery officer of the methods of handling the new Dutch three-gun firing batteries (see note on the organization in FIELD ARTILLERY JOURNAL for June, page 288).

ARTILLERISTICHE MONATSHEFTE. (A. Bath, Mohrenstrasse 19, Berlin.)

June, 1912.

Artillery in Defense.—Gen. Mayer.

The writer points out the disadvantage under which artillery in defense labors, in that it must be under cover to engage the attacking artillery, and also must be ready to meet the infantry attack at close range. He believes that, both in field and fortress warfare, the only solution of the difficulty is to be found in distinct separation of near and distant defense. His general plan is to put the guns intended to engage the enemy's artillery in covered positions somewhere within about 600 meters of the infantry line; to post all batteries belonging to units in reserve, and such others as may be required, several thousand meters in rear, with observers near the infantry line, to cover the dead space in front of the first class; and finally to send detached platoons of artillery, or machine guns, to the infantry line itself, to take care of points which can not otherwise be reached by fire without danger to friendly infantry. Howitzers, of course, are assigned to the first class, since they can act against both near and distant targets from the same position.

Burst Interval for Maximum Effect.—Gen. Rohne.

Mathematical discussion of the proper burst interval, and comparison of the results with the requirements of the German firing regulations. The writer concludes that the regulations are nearly correct for guns, but gives too low a burst for howitzers. He discusses methods of regulating height of burst, and favors regulation by a corrector on the fuze-setter, rather than on the elevation scale of the gun.

Pioneer Service in the Field Artillery.—C. v. K.

A review of the Pioneer Regulations, selecting those parts of especial interest to artillery and suggesting methods of instruction.

Service Practice in the Austrian Heavy Artillery.

Detailed description of two firing problems worked out by Austrian 12 cm. rifle, 15 cm. howitzer and 24 cm. mortar batteries.

Fuse Setters.—Lieut. J. Engel.

Description of several Krupp fuze-setters, hand and bracket.

A New Krupp Naval Gun.

Description of a mount for medium and light armament, especially designed for ease of manipulation by hand.

July-August, 1912 (double number).

The Hundredth Anniversary of the Krupp Establishment.

A history of the development of the Krupp works, with sketches of the lives of the leading members of the family.

French Views on the Co-operation of Infantry and Artillery.—Lieut. Süsserott.

A general statement of the principles of the French *liaison*, suggesting that the Germans might do well to adopt some of the French methods for co-operation of the arms in attack.

Evolution of Fortification in Germany.—"Marsyas."

An extended review of Lieut. Col. Frobenius' book under the above title.

A Field Artilleryman on the New Army Program.—Gen. Rohne.

Corrections and additions to the paper under this title in the May number (see FIELD ARTILLERY JOURNAL for June).

Miscellaneous Remarks on Our Field Artillery.

The writer proposes a number of changes in organization and training. His principal suggestions are the adoption of the four-gun battery, increase in peace strength of batteries, and better training for active and reserve officers.

Changes in the Heavy and Siege Artillery.—Capt. Marbach.

A review of the alterations published in March, 1912, in the Drill Regulations for Heavy Artillery. The matériel has been modified so as to give greater mobility, and now consists of 21 cm. mortars and 13 cm. rifles, both of modern type; the regulations have been modified accordingly.

New Fire Control Instruments.

Description of three recently introduced Goerz instruments—a small light battery commander's telescope provided with a compass, a plotting device, and a combination of the two.

Quadrant for Transferring Angles.—Col. S. v. Kobbe.

Illustration of a graphic method for calculating deflections.

Notes on Gun Carriage Design.—Capt. Edmund Roggla.

Mathematical paper on calculation of stresses in recuperator springs, and of velocity of recoil.

Cookwagons and Fireless Cookers.—Lieut. Olszewski.

A brief description of a recent German pattern of cookwagon, and comparison of its utility with that of the fireless cooker. The writer prefers the wagon; but mentions a proposed type of cookwagon which carries on its limber small fireless cookers for use in sending rations to outposts or other detachments.

MISCELLANEOUS ARTICLES.

MATÉRIEL.

Rocket for Attack of Aircraft.

A time-fuze rocket has been invented in Austria, for use against aircraft. It has a vertical range of 500 meters, and the fragments are effective up to 150 meters from the point of burst.

Militär Zeitung, April 20, 1912, p. 109.

Field Artillery Projectiles.

Description of the various types now in use, including the Ehrhardt and Krupp high explosive shrapnel.

Streffleur's Militärische Zeitschrift, May, 1912, p. 773.

Illuminating Projectile.

A new Italian 15.2 cm. illuminating shrapnel was tested at Viareggio in April. Bursting over water, it is reported to have illuminated the target long enough to permit fire to be adjusted.

Artilleristische Monatshefte, June, 1912, p. 470.

Italian Guns in Tripoli.

The Italian artillery has found it necessary to adopt various new expedients to meet conditions in Tripoli. One of the most interesting is the adaptation to the wheels of light guns of chains fitted with flat plates, similar to those used in siege artillery, to permit rapid maneuvering in deep sand; the experiment is said to have been very successful. Attempts are also being made to devise means for packing mountain guns on camels.

Artilleristische Monatshefte, June, 1912, p. 471.

Time Fuzes and Distance Fuzes.

A mathematical discussion of the distribution of points of burst, attempting to separate the various causes of error and determine what results could be expected from a perfect fuze; suggests the possibility of a fuze operating not by time but by distance traversed.

Mitteilungen über Gegenstände des Artillerie- und Geniewesens, No. 6, 1912, p. 553.

Mountain Guns.

Descriptions of the mountain guns in service in Europe, and of those furnished by private makers.

Rivista di Artigleria e Genio, May, 1912, p. 209.

English Heavy Artillery.

Description of the new English heavy field gun.

Schweizerische Zeitschrift für Artillerie und Genie, June, 1912, p. 236.

Combination Projectiles.

An extended review of the present situation with respect to combination projectiles. The writer concludes that while the adoption of such a projectile is highly desirable, further experiment is necessary to the development of an entirely satisfactory design.

Streffleur's Militärische Zeitschrift, Aug., 1912, p. 1287.

ORGANIZATION.

Austrian Mountain Artillery.

A paper on the reorganization of the Austrian mountain artillery, which now consists of three brigades, made up of seven regiments, aggregating 27 gun and 10 howitzer batteries. In a later paper the details of the armament will be given.

Schweizerische Zeitschrift für Artillerie und Genie, June, 1912, p. 239.

TRAINING.

Canadian Artillery.

A brief paper on Canadian battery training methods, interesting for comparison with our own militia.

Canadian Military Gazette, July 9, 1912, p. 8.

French High Explosive Shell Firing.

Strict and elaborate instructions have been given for methods of firing with 75 mm. high explosive shell, which indicate anxiety as to the safety of the projectile. Analysis of these instructions indicates that the shell must have light walls, a heavy charge, and a very sensitive fuze.

Deutsches Offisierblatt, No. 14, 1912.

Internationale Revue, Supp. 160, July, 1912.

Training of the Field Artillery in Pioneer Work.

A brief article calling attention to the importance of training field artillery troops in certain forms of pioneer work—not only in constructing cover for guns and observing stations, but in repairing roads, preparing stream crossings, etc.

Deutsches Offisierblatt, July 4, 1912, p. 461.

English Territorial Field Artillery.

A paper by an English instructor of Territorial field artillery on the value and requirements of that force. The writer considers that what is most urgently needed is opportunity for instruction of officers in practical gunnery, something on the plan of our Militia Course at Fort Sill.

Journal of the Royal United Service Institution, July, 1912, p. 989.

TACTICS.

German Heavy Artillery.

A brief paper on the use of heavy guns according to the new German regulations.

Schweizerische Zeitschrift für Artillerie und Genie, May, 1912, p. 188.

HORSES.

Measurements and Weights.

Explanation of the system of mensuration used by the judges at the French Concours Hippique of 1910. The following figures will be of interest.

Average Measurements of French Cavalry Horses.

	Light Cavalry.	Dragoons.	Cuirassiers.
Weight	825 pounds	935 pounds	1,045 pounds
Height	14.2	15.1	15.2
Girth	66″	68″	70″

Heights for Three-year-olds Purchased for French Army.

	Minimum.	Maximum.
Cuirassiers	15.1	16.½
Dragoons	15	15.2
Light Cavalry	14.2	15.½
Artillery	15.½	16

Heights for Horses and Mules in Italian Army.

	Minimum.	Maximum.
Horses for Lancers	14.1	
Horses for Light Cavalry	14.1	
Horses for Artillery and Engineers	14.3	16.2
Mules for Artillery and Engineers	14.1½	15.3
Horses for Infantry	14.3	16.3
Mules for Infantry	14.1½	
Horses for Officers—		
1st class	15	
2d class	14.2	
Purchased direct from dealers	14.1	

Bulletin of French Society for Promoting the Breeding of Army Remounts: *War College Translation No*. 2559.

BOOKS.

L'Artillerie au Combat.—Gen. Alexandre Percin. Paris, Henri Charles-Lavauzelle, 1912.

General Percin, as is well known, has never approved the new French Provisional Drill Regulations for Field Artillery. This book is a detailed review of the Regulations, pointing out specifically his objections. The principal point made, of course, is on the conflict of the Regulations with the Ministerial Circular of March 10, 1910, dealing with infantry and artillery in combination,—the old question of assigning artillery *to* an infantry attack, or *to support* it, which is perennially discussed in the French technical press.

General Percin argues strongly for the doctrine of the Circular as opposed to that of the Regulations; he desires to see the "temporary grouping" again become the rule instead of the exception, the artillery to be habitually placed under the actual command of the officer commanding the mixed group. He also finds the Regulations lacking in clearness.

The fundamental error, in his view, is that the board entrusted with the duty of drafting the Regulations was almost entirely composed of artillery officers, the other arms being represented, it is true, but only weakly; hence the unsatisfactory treatment of combined tactics. He urges a revision of that part dealing with combat by a board having a larger proportion of infantry officers; and that, in addition, entirely new Regulations on combat be prepared, tracing the proper relations of all the arms, and serving as a foundation for all the special drill regulations.

Notes on Military Explosives.—Gen. E. M. Weaver. 3d Edition. New York John Wiley and Sons, 1912.

A new edition of this standard text-book. The plan of the previous editions remains unchanged. The principal alterations are:—insertion of new data on trinitrotoluol; reduction of space given to certain obsolete explosives; and revision up to date of the Army and Navy powder specifications, smokeless powder tests, and regulations for transportation of explosives.

Gunnery.—Captain Jennings C. Wise, Adjutant, 1st Battalion. Field Artillery, Virginia Volunteers. Richmond, B. F. Johnson Publishing Co., 1912.

This book was a development from a series of lectures prepared by the writer for a school of instruction instituted by the commanding officer of the Virginia field artillery battalion for his own officers, the writer being chief instructor. The lectures having proved successful, it was decided to expand and amplify them, and put them in permanent form. To the original lectures has been added much material from American official and semi-official publications, and from a number of foreign works. The amount of labor involved in the selection and preparation of this material has been very great; but the net result is a very complete and valuable manual of the elements of field artillery gunnery, especially useful to militia officers, for whom it is intended.

Part I is an elementary course in mathematics, from Artillery Circular H of 1893. Part II treats of explosives, and gives a good account of the nature, manufacture and use of black, brown and smokeless powders, nitroglycerin, dynamite and detonators. Part III treats of ballistics, interior and exterior, but mentions general principles only and does not go into the mathematics of the subject. Part IV deals with shrapnel and shrapnel fire. Part V, Practical Gunnery, occupies about half of the book; it discusses the various items of firing data, the methods

of determining them, ranging, observation of fire, and the peculiarities of masked positions.

The whole book is one with which its writer may well be satisfied, and which should prove of great assistance to the beginner in the study of gunnery. One noticeable feature, greatly facilitating its study, is the great number of diagrams, presenting the solution of all problems graphically as well as analytically.

La Crise du Demi-sang Français.—General Dubois, Commandant la 1*re* Division de Cavalerie. Paris, Henri Charles-Lavauzelle, 1912.

The author claims that many stallions at the Government studs are unfit for use, as few farmers will breed to them. These stallions are of the large coach and light trotter types; their offspring is a worthless product on the farmers' hands, the automobile having destroyed the demand for such animals. General Dubois compares this state of affairs with the methods of the German Government, which produces on its breeding farms a type of horse suitable for both farm and army use,—a heavy-weight, half-bred hunter type, with strong compact build, large bones and good conformation. He also points out the encouragement given by the British Government in late years, in the shape of premiums to owners of stallions and brood mares that meet certain requirements, in order to reduce the exportation of good animals. In France, where this system also exists, the premiums have too often been given to horses unfit for the army.

Notwithstanding the demands of farmers for a different type of Government stallions, little has been done to meet the situation, and purchasing officers find it harder each year to find an adequate supply of animals. The opposition to change comes from a small but influential minority of trotting horse breeders, who, having strong financial backing from race-track gate receipts, control the special press.

General Dubois recommends that trotting and coach stallions be eliminated from the Government studs, and their places taken by Anglo-Norman half-breds, such as desired by the farmers and the army; also that substantial premiums be paid for colts up to the standard adopted by the Remount Department.

M. F. DeBarneville.

The Rasp.—Class of 1912, Mounted Service School. Fort Riley, Kansas, 1912.

The Class of 1912 at the Mounted Service School has made a new departure, by making its class book not merely a collection of trivialities, interesting or amusing only to the members of the class and their friends, but a serious work of permanent value. It contains a history of the school; a record of the year's work of the class; articles on hunting, polo, military racing, horse shows, and horse breeding; and descriptions of all the great European military riding schools. One of the articles is Colonel Mott's paper on the International Competition for Officers' Chargers at Rome, May, 1911, originally printed in the FIELD ARTILLERY JOURNAL for December, 1911. The whole book is profusely illustrated.

FIELD ARTILLERY DIRECTORY.

REGULAR ARMY.

1*st Regiment* (*Light*).—Col. David J. Rumbough: H. Q. and 2d Bn, Schofield Barracks, H. T.; 1st Bn, Manila.

2*d Regiment* (*Mountain*).—Col. E. A. Millar: H. Q. and 2d Bn, Vancouver Barracks, Wash.; 1st Bn, Manila.

3*d Regiment* (*Light*).—Col. Charles G. Treat: H. Q. and 1st Bn, Fort Sam Houston, Texas; 2d Bn, Fort Myer, Va.

4*th Regiment* (*Mountain*).—Col. Alexander B. Dyer: Fort Russell, Wyoming.

5*th Regiment* (*Light*).—Col. Granger Adams: Fort Sill, Oklahoma.

6*th Regiment* (*Horse*).—Col. Eli D. Hoyle: Fort Riley, Kansas.

MILITIA.

1*st 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.

2*d Inspection District*.—Capt. Upton Birnie, Jr., and Lieut. Harry Pfeil, Inspectors, New York City.

New York.—1st Regiment, Col. ————: H. Q. and 2d Bn, New York City; Btry A, Syracuse.

2d Regiment, Col. George A. Wingate: H. Q., Btries A and B, New York City; Btry C, Binghamton.

New Jersey.—Battery A, Capt. Harry L. Harrison: East Orange. Btry B, Capt. Samuel G. Barnard: Camden.

3*d Inspection District*.—Capt. Oliver L. Spaulding, Jr., Inspector, Washing ton, 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.

4*th 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.

5*th Inspection District*.—Lieut. John C. Maul, Inspector, Columbus, 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.

6*th Inspection District*.—Capt. Charles C. Pulis, Inspector, St. Paul, Minn.

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.
7*th 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.
8*th Inspection District*.—Maj. O. W. B. Farr, 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.
New Mexico.—Btry A, Capt. M. S. Murray: Roswell.
9*th Inspection District*.—Capt. Joseph F. Barnes, Inspector, San Francisco, Cal.
Oregon—Btry A, Capt. Hiram U. Welch: Portland.
California.—Btry A, Capt. Reuben A. Ford: Los Angeles. Btry B, Capt. Ralph J. Faneuf, Oakland.
Unassigned.
New Hampshire.—Btry A, Capt. Edwin L. Towle: Manchester.

ACTIVE MEMBERSHIP PERCENTAGES. FIELD ARTILLERY ASSOCIATION.

Unassigned officers, U. S. F. A.	95
3d Regiment	90
1st Regiment	84
4th Regiment	84
6th Regiment	84
2d Regiment	74
5th Regiment	74
5th Militia District	65
1st Militia District	54
9th Militia District	53
2d Militia District	50
3d Militia District	47
7th Militia District	35
6th Militia District	29
8th Militia District	26
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.