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CAPTAIN MARLBOROUGH CHURCHILL

FIELD ARTILLERY, UNITED STATES ARMY

Editor

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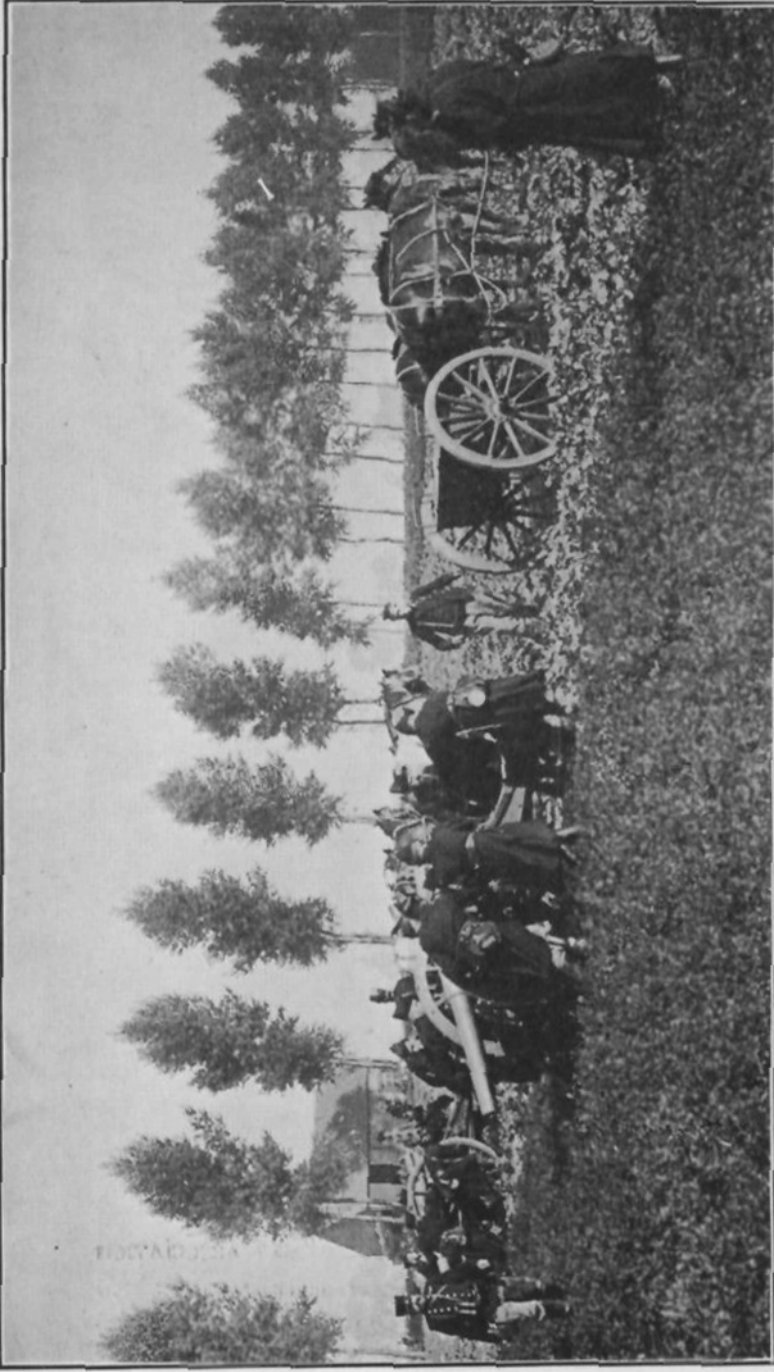
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BELGIAN FIELD ARTILLERY NEAR ANTWERP.

The Field Artillery Journal

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THE NEW GERMAN FIRING REGULATIONS, JANUARY 11, 1914.

BY FIRST LIEUTENANT EDMUND L. GRUBER, 5TH FIELD ARTILLERY

The new German Firing Regulations for Field Artillery which went into effect January 11, 1914, is the second completely revised edition since the introduction of the long recoil gun. The first edition appeared in 1907. Its tone was considered by many progressive field artillerymen to be a little too conservative, because in many cases it still adhered to former principles. It fell somewhat short of acknowledging and meeting those rapid changes and developments in modern field artillery matériel and methods which had more or less crystalized during the previous ten years. The 1907 edition of the Regulations, although meeting most of these advanced ideas in a liberal spirit, made no very radical changes. There were many reasons for this. Many of the theoretical principles had not been fully confirmed by war, and this in spite of the fact that the Russo-Japanese war had been brought to a conclusion just a short time previous. Another reason for this liberal conservatism was the experimental stage and development of many accessories, such as sights, fuses, unit projectiles, observing instruments, range finders, and the like. For instance, until recently, indirect laying was obtained by means of an aiming stake and an azimuth circle with a peep sight. The reasons for retaining this somewhat crude method were the optical and mechanical imperfections of the panoramic sight at that time, and the question of economy. To install the new panoramic sight in the field artillery of the active army alone meant an expenditure of \$1,500,000 for sights only, not to mention other incidental expenses as a result of this change in addition to the cost of an adequate reserve supply. It was the same with other parts of equipment. As a general rule, the Germans will adopt nothing for the service at large until it has passed the experimental stage; and in the meantime the old must

answer the purpose. For instance, the Germans would have got along in the best way they could with a Weldon Range Finder until their objective substitute, a fixed base ranger finder, had been perfected and would not have adopted a telemeter as a compromise.

But there is also a still greater reason for not making violent changes in methods or radical changes in the matériel, and that is the necessity of always considering the former training of the men in the reserve and the imminence of war. Germany has always felt that the day would come when it would be impossible to avert a great war. It is well known that during the past ten years preparations for mobilization were made on four different occasions. In an army where 250,000 to 300,000 men are each year transferred from active service to the reserve, it is very important that changes be made very gradually and in their extent not more than can be readily assimilated by these men of the reserve during the three weeks of each year that they again serve with the colors.

The Firing Regulations of 1907 were not arbitrary, but plainly provisional, and permitted a great amount of latitude. As a result of the tests and firing practice at their school of fire and in the regiments, a provisional revision of the 1907 edition was published in 1911. This was a very satisfactory change, was based upon good, sound principles and reflected not only a progressive spirit but also an exhaustive study of the subject of field artillery firing based upon statistical and practical data obtained from experimental and service firing.

This provisional revision was, however, incomplete. It contained only a chapter on practical gunnery and the firing regulations proper. The chapters on the training of the personnel in the firing battery, the use of the different instruments and accessories, the preparation for fire, the regulations for the conduction of firing practice, the regulations for gunner's instruction and competitions, and the like, all these were not revised. Most of these things had formerly been taken up in special orders and manuals; they now form a part of the new Firing Regulations and are embraced in Part II.

The Germans have not, as we have, a General Drill Regulations. The instruction manuals for the field artillery are contained in several smaller manuals, in volumes of small and convenient size. Among them may be mentioned Manual for Dismounted Duty; Manual on Gymnastics; Drill Regulations Proper; Supplement to

the Drill Regulations (a condensed handbook profuse with illustrations); the Firing Regulations; Manual on the Operation and Construction of Targets, etc. Each manual covers its subject completely and contains about one hundred and seventy-five to two hundred pages. These manuals all apply to the field artillery, that is, to light, horse and howitzer batteries. When any deviations on account of difference in matériel are necessary, this is specially noted. For instance, in the Drill Regulations there is a special part that applies to the light field howitzer only; this is printed on light blue paper. In other manuals, matter of special application to the light howitzer is printed in English type, the rest in German type.

It is intended to discuss here only the new Firing Regulations. The first thing noticed is that they are provisional. The implied latitude is of course intentional. Changes and developments are too rapid to permit any narrow prescriptions. Improvements in matériel and accessories are constantly taking place and no one can tell how these will effect the so-called "rules of fire." But an elastic manual of this kind must be kept up to date by promptly publishing interpolations and changes as soon as their necessity is evident. It is plain that almost any change in matériel, projectiles, fire control instruments, etc., may bring with it a change in methods and conduct of fire. Take, for instance, the new meter base range finders. Recent field tests and experiments covering quite a long period have shown that the range error was within one hundred yards in something like sixty per cent of the cases and within two hundred yards in something like ninety-five per cent of the cases. In other words, the chances are more than even that an appropriate change of two hundred yards will give a bracket and if not, then a further change of two hundred yards in the same direction will almost certainly give the bracket. In studying this one thing alone, many interesting conclusions may be formed which will shorten the time to fire for effect. This goes to show how easily our firing regulations are subject to change, therefore how elastic and provisional they should be. And no one knows now what the future may hold, especially with improvements made in observation ladders, fuses, observation from aircraft, perfections in observing instruments, and last but not least, the flood of practical experience as a result of the present great war.

In the new German Firing Regulations the chapter on practical gunnery is short and clear, as well as complete. In the German

book are discussed (a) the elements of the trajectory; (b) action and effect of the different projectiles; (c) general discussion of the probability of fire; (d) necessary corrections to be made in height of burst, angle of site, on account of wind or due to errors for the day or for the range; (e) choice and use of aiming points and the determination of the elements of fire. This chapter is fully explained by many diagrams.

The following points may be of interest:

For the light howitzer there are seven different powder charges or zones. Platoon commanders have a range table in order to choose the proper range, that is, the range to give the desired angle of fall, the proper zone showing the particular range in red ink. In order to penetrate horizontal cover an angle of fall of at least twenty-eight degrees is necessary. This is first obtained at two thousand one hundred meters and over when using zone fire. The caliber of the German light howitzer is four and two-tenths inches; the unit projectile which it fires weighs about thirty-four and three-fourths pounds; the bullet weighs ten grams (one hundred and fifty-five grains). This unit projectile can be set for five different actions, percussion (high-explosive effect) with delay and with non-delay action, as time shrapnel, as time high explosive shell and as canister. Its fuse limits are from three hundred to five thousand three hundred meters. The projectile is not armed for percussion effect until at six hundred meters. In order to obtain canister effect, the fuse is set on the "red mark." The average angle of opening of the howitzer projectile when set as shrapnel is thirty-two degrees, formerly it was fourteen degrees. This is due to the fact that in the old projectile the case did not burst. With the new one it generally does; if the case does not burst the angle of opening is only fifteen degrees. This increase in the angle of opening of this projectile had to be obtained in order to increase its effective depth and width, and to reduce the unnecessarily large density of hits. The angle of opening of the howitzer projectile when set as time shell is one hundred and ninety degrees. It can therefore produce effect in a trench when bursting directly overhead or even a little beyond the target. The number of bullets in the howitzer projectile is not published in manuals. But as Rohne has pointed out, it is probably considerably less than for howitzer shrapnel, because in constructing a unit projectile for the light howitzer, the shrapnel effect had to be reduced in order to

obtain a sufficient high explosive percussive effect. The number of bullets in this unit projectile is, therefore, about four hundred and twenty-five. The weight of these bullets, ten grams (one hundred and fifty-five grains), may seem too small to us, but it must be remembered that the Germans do not think much of howitzer shrapnel fire with reduced charges, and that all their howitzer shrapnel fire is usually with the highest charge, corresponding to our third zone. The terminal velocity is, then, great enough to give a ten-gram bullet what they consider an adequate striking energy. In this connection it may be noted that for target practice, a practice howitzer projectile is used. The fuse on this is the same as for the service projectile. Its shrapnel action and effect are also the same, but it has no shell effect. One must suspect that this is probably due to the danger of unexploded projectiles set for shell action. Those who have been at Fort Sill know of the great danger on the reservation from shell that have failed to explode. In spite of repeated warnings, some of these have been foolishly picked up. The German regulations for policing the firing ground after firing will be discussed later.

The shrapnel of the light gun is practically the same as our own, weight fifteen pounds, number of bullets three hundred, weight of bullet ten grams (one hundred and fifty-four grains). Its time train extends from two hundred meters to five thousand three hundred and fifty meters. Its average angle of opening is nineteen degrees (three hundred and forty mils), formerly it was seventeen degrees. This overcomes somewhat the advantage which the French gun had in effective depth of the ground pattern due principally to its flatter trajectory. This increase in the angle of opening has also extended the so-called "critical range," that is, the range at which the angle of fall is equal to one-half the angle of opening. This now becomes about three thousand two hundred meters. For our gun, with an average angle of opening of fifteen degrees, this critical range would be three thousand yards. In Germany it is customary in making calculations to eliminate a certain percentage of ineffective isolated bullets or fragments on the outer limits of the cone; this number is usually from ten to fifteen per cent. The distribution of bullets within the cone is uniform for the gun shrapnel and less dense in the center for the howitzer projectile set as shrapnel. The new howitzer unit projectile therefore probably also has a radial bursting charge. As time shell, both have a hollow

cone in the center. The angle of opening of the time shell of the gun is one hundred and fifty degrees, formerly it was only one hundred and fourteen degrees. The time shell of the gun can therefore produce effect when almost directly overhead its target. The effective depth of the time shell for both gun and howitzer is not very great. The effective width of the time shell is, however, much greater than for the time shrapnel. The limits of the effective

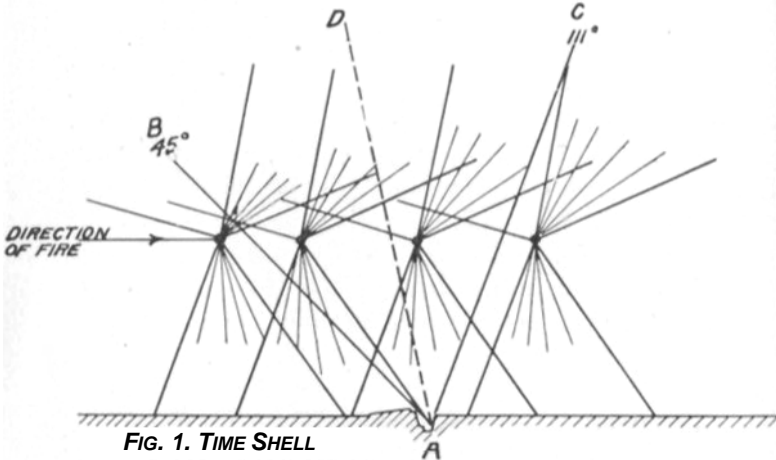


FIG. 1. TIME SHELL

HOWITZER-RANGE 3000 M. -H.B. 5 MILS - SHOWING WITHIN WHAT LIMITS BURSTS MUST OCCUR TO PRODUCE EFFECT ON A TRENCH WITH 45° DEFILADE.

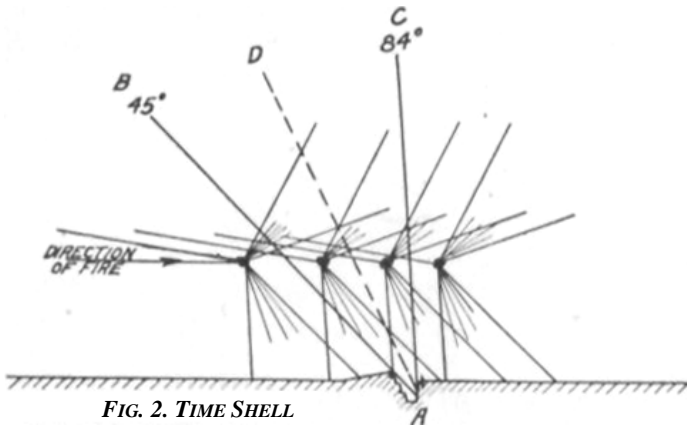


FIG. 2. TIME SHELL

GUN-RANGE 3000 M. - H.B. 3 MILS - SHOWING WITHIN WHAT LIMITS BURSTS MUST OCCUR TO PRODUCE EFFECT ON A TRENCH WITH 45° DEFILADE.

burst intervals, that is, the space near the target within which the shell must burst in order to be effective, is also comparatively small. Only one-third of the fragments, that is, the lower part of the cone of dispersion, can produce any effect; the other two-thirds of the fragments fly upward and sideward and lose too much of their striking energy before reaching the ground to be effective. Taking an infantry trench that has a forty-five-degree protective defilade from the fire of a hostile battery at three thousand meters—the line AB (Figs. 1 and 2) marks the path of the effective fragment having the least angle of fall, while AC marks that of the fragment with the greatest angle of fall. The line AB is fixed by the angle of defilade of the parapet, which is forty-five degrees; the line AC, by one-half the angle of opening of the time shell

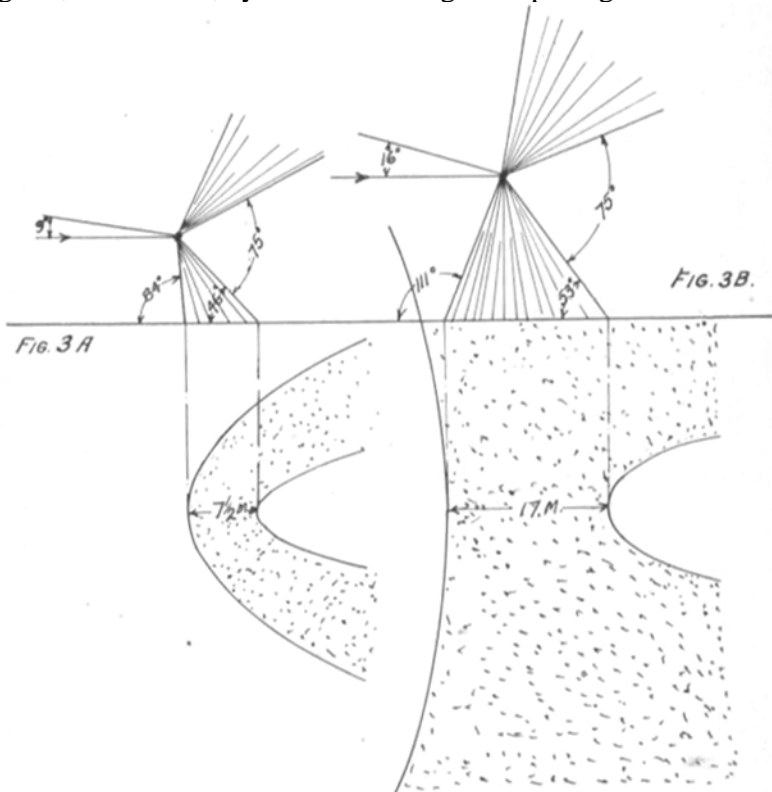


FIG. 3A - RANGE OF OPENING AND PATTERN OF GUN TIME SHELL.

FIG. 3B - RANGE OF OPENING AND PATTERN OF HOWITZER TIME SHELL.

(seventy-five degrees for the gun, ninety-five degrees for the howitzer), plus the angle of fall at three thousand meters (ninety degrees for the gun, sixteen degrees for the howitzer, full charge). For the gun the line AC then makes an angle of eighty-four degrees; for the howitzer it is one hundred and eleven degrees. Now by plotting these limits, it will be seen within what narrow limits the bursts of the time shell must occur to produce any effect. Low burst are therefore not desired because the chances of obtaining effective bursts are then least. The greatest effect will be produced when the bursts are on or near the bisecting line AD. The chances for producing effect are, therefore, greater when the bursts are above normal rather than below.

The angle of opening of the hollow cone in the center of the cone of dispersion is about seventy-five degrees (estimated). Figures 3A and 3B show diagrammatically time shell bursts for a range of three thousand meters, assuming a height of burst of three mils for the gun and five mils for the howitzer. For the gun the effect extends about twenty meters on each side of the line of fire, and for the howitzer about forty meters on each side.

The Germans expect much from their high explosive shell and no doubt now also have a unit projectile for their light gun. When a battle line becomes as fixed as is the case now on the Franco-German border, where both sides are opposing each other along strongly intrenched and fortified lines, the high explosive shell will have a tremendous advantage over the shrapnel and will no doubt be used by both sides almost to the total exclusion of the latter.

From the above it will be seen that all projectiles have been increased in effectiveness. An exhaustive study of the effectiveness and efficiency of shrapnel fire has been made by Lieutenant General Rohne, the editor of the *Artilleristische Monatshefte*. His essays and articles on this subject have been translated and General Rohne very graciously gave his permission last summer to publish them for private distribution at our School of Fire. It is hoped that this will soon be done.

The German Firing Regulations then discuss the action and effect of the different projectiles against various targets, pointing out circumstances where one projectile or action is superior to another. This is very instructive. Here we also note the first

mention made of the German system of time firing, in that it clearly emphasizes the necessity when using time fire (shrapnel and shell) of obtaining effect quickly without first determining the actual range at which the effect will be greatest. As a general rule, the target is included within a bracket of a certain depth. This zone is then searched by dropping back and firing at successive ranges, with the assurance that at least one of these ranges has produced the greatest effect upon the target. Now in continuing the firing, an attempt is made to determine the most effective range, or at least to eliminate the ineffective ranges.

In percussion fire, on the other hand, an attempt is made to determine the most effective range from the very beginning. This is the range whose center of impact is closest to the target, for only when the shots fall close to the target can effect be expected in percussion fire.

The next short chapter discusses the subject of probability of fire. This is then followed by a discussion of the corrections that are necessary. It is stated that the conditions of weather effect the range more than they do the time of burning of the fuse. Therefore in winter when the gun shoots short, more low bursts and grazes may be expected. In summer, on the contrary, when the gun shoots over, more high bursts may be expected. At high altitudes the fuse may burn so slowly that even in summer grazes may result. The effect of wind and an incorrect angle of site are also discussed.

The burst is raised or lowered not by shortening or lengthening the time of burning of the fuse as we do with our corrector, but by raising or lowering the trajectory. This is done by means of a regulator on the sight bracket. The smallest division of this regulator or corrector is equal to two and one-half mils for the light gun and four mils for the howitzer. With our gun, the same result would be obtained if we had no corrector scale on the fuse setter and instead had No. 1 correct the height of burst by using the angle of site. As a result, the burst is raised or lowered vertically and there is no change in the burst interval. In thus using their regulator, the actual range of the trajectory (but not of the burst, which is unchanged as far as range is concerned) is therefore increased or reduced by eighty meters for short ranges to thirty-meters for long ranges. The method of ranging will be discussed later.

The chapter on aiming points is new and very good. Parallel fire is the rule.

Under "Preparation for Fire" are discussed the observation of the sector assigned, reconnaissance of the target, choice of observing station as well as the methods of laying and of fire. As assistants, the battery commander has two non-commissioned officers with aiming circles to reconnoiter the target and the sector. The musicians are also non-commissioned officers. They are not used merely as horseholders, but perform duties of great assistance to the battery commander and are among the most important members of a battery detail. The recommendation that the battery commander take another officer with him as an assistant at the observing station is something new. This is especially necessary when the battery is at a distance from the observing station, or in an indirect fire position. This officer should keep in touch with the situation and be able to step in at any time to take the battery commander's place, either temporarily or otherwise. This idea is excellent. With the general use of indirect fire positions and the comparative safety at the battery, the duties of the platoon commander at the battery are of less importance than formerly and in many cases it may be advisable with only two lieutenants with the battery to leave only one officer with the firing battery and to use the other as an assistant to the battery commander at or near his station. In actual war this would probably always be done anyway. The first sergeant, on the other hand, is not needed so near to the battery commander. He could perform his duties more efficiently and render better service if he were at or near the firing battery, rather than as an assistant with the battery commander. He could then be used as a platoon commander.

For adjustment, that part of the target which facilitates adjustment should be selected. The different things which the battery commander must consider and order are then taken up. When in an indirect fire position he must determine the minimum range to clear the covering crest. The manner in which this is done is as follows: The height of the covering crest is measured at the gun position by a non-commissioned officer, with an aiming circle. The smallest division is two and one-half mils. The number of divisions read are then multiplied by one hundred for the gun or by fifty for the howitzer, and to this product is added the distance from the guns to the crest. The result is the minimum range. Take this

example for the gun, for instance: The height of the covering crest is twenty divisions (fifty mils) and the distance of the guns behind the crest is two hundred meters. Then twenty times one hundred, plus two hundred, equals two thousand meters, the minimum range. In this formula, the angle of site need not be considered if not more than ten divisions (three hundred plus twenty-five mils). This will usually include nearly all targets except in a hilly or mountainous terrain.

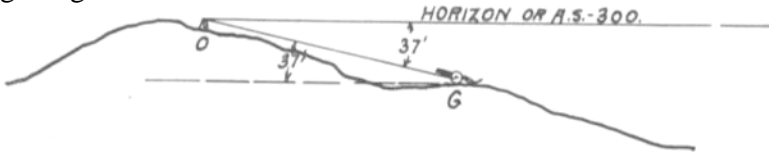
In our service, we usually work this problem very easily with the battery commander's slide ruler. There are, however, a number of ways to determine it without the slide ruler. The knowledge of a rough range table for the particular gun and some means or method of measuring an angle in mils are necessary. The following rough range table for the three-inch gun is quite accurate, convenient and easily to be remembered:

Range.	Angle of elevation.	Average increment in mils per 100 yds in range.
1000	20	
1500	35	3
*2000	50	
*2500	70	4
*3000	90	
*3200	100	
*3500	115	5
4000	140	
4500	170	6
5000	200	

Of these, the most important are those marked "*." The difference column is also very easily remembered and enables one to calculate the angle of elevation for any range with considerable accuracy. Between one thousand and two thousand yards, three mils difference in elevation produces a change of one hundred yards in range; between two thousand and three thousand yards it is four, and so on. As an example, if it is desired to determine the angle of elevation for two thousand seven hundred yards: angle for two thousand five hundred is seventy; two thousand seven hundred is between two thousand and three thousand, therefore eight mils more are to be added, or seventy-eight mils, which is almost exactly the tabular value. For our three-inch gun the angle of departure is

about two mils greater, giving a small factor of safety. With the four and seven-tenths-inch howitzer, the jump is negative because the gun is suspended, the angle of departure being smaller than the angle of elevation by about eight mils in the third zone and by about five mils in the first and second zones.

One and one-half times the angle of elevation gives approximately the angle of fall. The average angle of opening of our three-inch shrapnel is about two hundred and fifty mils. The approximate time of flight is: up to three thousand yards, one-tenth the angle of elevation; over three thousand yards, one-twentieth the angle of fall. With this rough range table and information, many problems in practical gunnery can be quickly solved. For instance, if the observer is on the covering crest in front of the battery and the sector assigned fixes the minimum range as angle of site, two hundred and ninety; range, one thousand nine hundred; required, to determine the position of the guns to clear the crest at the minimum range. Figure 4.



**FIG. 4 TO DETERMINE POSITION OF GUN
FOR A MINIMUM RANGE.**

The angle of elevation for one thousand nine hundred is forty-seven. But the angle of site of the minimum range is two hundred and ninety, therefore the actual elevation of the gun will be ten mils less, or forty-seven minus ten, equals thirty-seven. Therefore, if the observer O can measure down thirty-seven mils from three hundred, or the horizon, he will mark a point G, upon which or in rear of which a gun, if placed in position, would clear the crest. As a matter of fact, it will clear by a good margin, for we have as factors of safety: (a) the height of the instrument or the eye of the observer above the crest. If the observer takes proper cover, this should, of course, be small; (b) the height of the bore of the gun; (c) the range, although only one thousand nine hundred from the crest is probably more from the guns; (d) the angle of sight, although two hundred and ninety from the crest is usually greater at the guns, which are lower. This method, although not prescribed in German regulations, is commonly used in their field

artillery. If the observer has calibrated his hand or has a graduated field glass and is able to select a horizon, no instrument is necessary. Attention might here be called to a very quick means of measuring larger angles with the field glasses. Hold the glasses vertically in front of your eyes and adjust the strap by which the glasses are slung around the neck so as to calibrate as indicated in the illustration. The length of strap as manufactured will usually give these values. Figure 5.

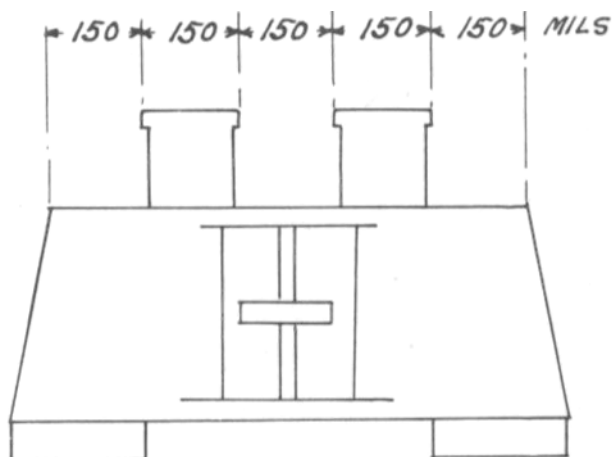


FIG. 5

FIELD GLASSES TO MEASURE LARGE ANGLES.

To determine if from a certain gun position a crest can be cleared at the minimum range, the operation is similar. Measure from the gun position the height of the crest in mils; the corresponding range will be the minimum range, provided the angle of sight of the target is not less than three hundred and the covering crest not more than two hundred yards from the guns. If the angle of sight is less than three hundred, a corresponding increase in range must be made (one hundred yards for each four mils at mid ranges), and if the distance of the covering crest is more than two hundred yards, this distance should be added to obtain the minimum range.

The French determine the position of the guns for minimum range as follows (Figure 6): A man kneeling at A on the covering

crest places himself so that he can just see the target over the crest. He then measures up from T, an angle equal to the angle of elevation for the range, and notes this point R on the landscape. If this is impossible, as is usually the case, he must then choose an assistant B, who, standing, lines himself up with A and places himself so that he also can just see T over the crest. In the first case, the man A walks down the hill until he reaches a place G, from which he, when in a kneeling position, can just see the point R disappearing over the crest. This then marks the position of the guns for the range of the target. In the second case, the man A faces about in the kneeling position and measures down from B's eyes to an angle equal to the

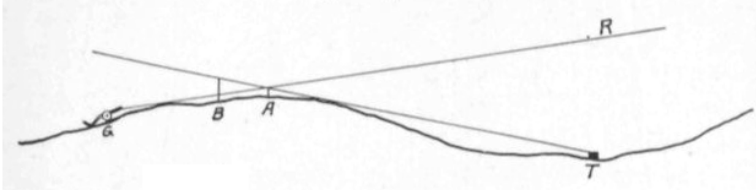


FIG. 6

TO DETERMINE POSITION OF GUN TO CLEAR GREST.

angle of elevation for the range. The point where this line strikes the ground G will then also mark the position of the guns for the target.

Returning to the new German Firing Regulations. Under "Choice of the Method of Laying," it is prescribed that direct laying is to be used against such targets as can be easily designated in commands or are plainly visible to the gunners, and against such moving targets that the gunners can follow.

Parallel fire is the rule, but it is also prescribed that the sheaf should be opened or closed from the very beginning, when necessary. In preparing for fire, those orders which require the longest time for fulfillment should be given first, so that all preparations will be complete by the time the battery is ready to open fire.

The subject of observation of fire and the use of auxiliary observers, especially against masked targets, is also discussed.

Heights of burst are designated as follows: "Normal" is two to four mils; at shorter ranges, bursts should group themselves about the lower limit, at long ranges about the upper. All bursts above "normal" are designated as "high"; those below "normal" as "low." Bursts below the target are designated as "below T." The height of burst is measured with the graduated scissors instrument or with

field glasses. The graduations for deflections are by divisions of four mils; for height of burst the divisions are again sub-divided into two-mil sub-divisions. When firing against air craft with time shell, the bursts are called either as "line," "too high" or "too low." Due to dispersion, occasional high or low bursts, or grazes or bursts below the target may be expected in a well-adjusted salvo or volley. If no graduated observing glass is available, the observation of one or, at most, two grazes out of six shots will offer a good basis for a proper height of burst.

Fire for Adjustment.

Adjustment is by platoon, firing being begun at the estimated or measured range. Any known errors for the day between the trajectory and the time of the fuse should be corrected by the regulator (corrector) before opening fire. For instance, in frosty, damp, cold or foggy weather, by raising the regulator one point (two and one-half mils); in dry and warm weather by lowering it one point.

The effect of changing the height of burst by this use of the regulator is to raise or lower the burst vertically and not to change the range of burst as with our gun. Practically it is correcting the burst by changing the angle of site. If, therefore, an original error is made in the angle of site, this will be corrected during firing by the regulator.

Bursts that are low enough for observation are used in determining the bracket.

The following grazes are also used in determining the bracket: (a) all grazes over; (b) all grazes very far short; (c) all grazes short obtained with a regulator setting that also gives air bursts; (d) grazes short which would be air bursts if the regulator were raised one point.

No bracket is attempted against (a) close targets, say about six hundred meters distant; (b) against instantaneous targets, meaning thereby targets that will be visible or can be taken at a disadvantage for a very short time only.

When fire for effect is to be with percussion fire, then adjustment is also with percussion fire.

For adjustment, a height of burst is desired that will give about half grazes and half bursts in air, in other words, a zero height

of burst. Changes in the regulator to lower the bursts are usually made by one point (two and one-half mils), but in practice, greater changes are also made. If after having had air bursts the regulator is lowered one point (two and one-half mils) and two grazes are obtained, this setting of the regulator is kept for adjustment. If the first two shots are grazes or are lost, the regulator is raised one or more points until at least one air burst is obtained in the salvo. If after raising the corrector one point, the height of burst is found to be too high, the corrector is lowered again. If the bursts are not sufficiently distinct to permit good observation, the fire is concentrated and volley fire employed.

When a zero height of burst is obtained, that is, when the height of burst is properly fixed for adjustment, all grazes are used for observation. But if the height of burst for adjustment has not yet been fixed, a range giving grazes just short is not reliable, and it may sometimes be necessary to repeat this particular range after the proper height of burst for adjustment is determined.

If in exceptional cases, difficulty is encountered in bringing air bursts in contrast with the target (for instance, against a flat crest, or infantry trenches of low relief, also when the ground is covered with snow), and for this reason mostly grazes are desired, these grazes should be obtained by an appropriate lowering of the regulator, but the change should not be more than one point below the zero height of burst.

If during adjustment, only one shot in a platoon salvo is observed, this shot may be used as a basis for this range. The bracket should be obtained by bold changes in range, but changes should never be less than two hundred meters. The officer firing must take advantage of every means that will shorten the time consumed in obtaining adjustment. Ordinarily the bracket is narrowed by splitting the last bracket. However, in exceptional cases it may be advantageous or advisable to narrow the bracket by successive jumps or increments from the short limit. A one hundred-meter bracket is obtained against stationary targets whenever possible.

If when the height of burst is properly adjusted, one shot of a platoon salvo is observed as target, or close to the target (that is, smoke of burst appearing first in front and immediately afterward in rear of the target), or if in a platoon salvo one shot is observed over and the other short, further bracketing is discontinued. This range is then taken as the short limit of the bracket.

Against moving targets, the bracket varies from one hundred to four hundred meters, according to the speed and direction of the target. Against such targets, if the salvo is observed as not very far short of the target, that is, if the distance short appears less than the width of the proper bracket, this range is at once taken as the short limit of the bracket. Against retreating targets, it is advisable to observe a shot or salvo over before passing to fire for effect.

If compelled to fire over friendly troops in the vicinity of the target, fire for adjustment is opened with a range somewhat greater than the estimated or measured range. The proper bracket is then obtained by successive decrements in the range.

If the target is behind a mask or cover, a point in this mask or some prominent feature of the terrain close to the target is chosen for adjustment.

Fire for Effect (Time Shrapnel).

Against stationary targets, fire for effect is opened by salvos or volleys at a range one hundred meters less than the short limit of the bracket. This is called the initial range for effect. But if during adjustment, the position of the target within the bracket is accurately determined, fire for effect may be opened at some other of the successive searching ranges.

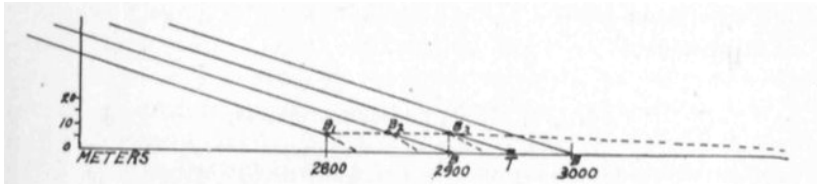
In passing to fire for effect, the burst is raised so as to obtain normal bursts. In most cases it will be sufficient to raise the regulator one point (two and one-half mils). If, however, the regulator had previously been lowered to obtain a majority of grazes, as in cases of trenches of low relief, or in a snow-covered country, then a bold change upward must be made. If the average height of the first salvos or volleys is too high or too low, an appropriate change in regulator is made.

Fire for effect is then at three successive ranges differing by fifty meters, beginning with the initial range (one hundred meters less than the short limit of the bracket), until observations warrant some change (Figure 7). Ineffective ranges are eliminated. If a certain range is determined as giving proper burst intervals, all further firing is at this range alone until later observations show the necessity of including some other range.

Burst intervals are considered satisfactory if in a volley or salvo

(six shots), there are observed one over and the rest short, or if on repeating this range some doubtful bursts are observed along with this one over. The old regulations considered the burst interval satisfactory if two overs were observed and the rest short. The burst interval is also satisfactory if all bursts are observed short, provided that an increase of fifty meters in range gave two or more bursts over. Although not so laid down in the Firing Regulations, the rule in practice is that if at a certain range one shot out of six is observed over, all other firing is at this range unless observation indicates a change.

If observation shows a range unsatisfactory, this range is immediately eliminated. The range and interval burst are unsatisfactory if two or more out of six bursts are observed over; or



$B =$ H.B. FOR ADJUSTMENT
 $B_1 =$ BURST FOR INITIAL RANGE.
 B_2 } BURSTS FOR SUGGESTIVE
 B_1 } RANGES 50 AND 100 M. GREATER.

FIG. 7.

if after increasing the range all bursts are still observed short. If a shorter of the successive ranges for effect is eliminated, a corresponding greater one should be included and vice versa, unless observation at one of the other successive ranges for effect has made this unnecessary. If in this procedure, the initial range for effect has changed by more than one hundred meters without disclosing some positive information concerning the limits of the proper bracket, ranging must be repeated and a new bracket obtained. If after longer firing only doubtful observations are made at a particular range, this range should be temporarily verified by lowering the regulator (verifying salvos). This should be done at the middle and long range for effect and not at the short range, because the former are nearer to the target and can more easily be brought in contrast with the target, while at the latter range low bursts with large burst intervals promise very little effect. Therefore, in most cases of this nature, two ranges must be verified.

If the bracket obtained is greater than one hundred meters, as in

bracketing a mask, and nothing is known of the distance of the target behind the mask, volleys or salvos are used at successive ranges differing by one hundred meters, walking through first at the one hundred-meter ranges and the second time at the intermediate fifty-meter ranges. If there is reason to believe that the target is some distance below the crest or mask, the bursts should be lowered occasionally to avoid overshooting.

Against close targets up to six hundred meters, fire for effect is opened at once at the estimated range without determining a bracket. In such cases the regulator should be raised one or two points (two and one-half to five mils) from the very beginning to prevent grazes. Successive ranges should then not differ by less than one hundred meters. Rapid fire or fire at will is also advisable.

If when firing with the light gun the target is less than two hundred meters distant and when firing with the light howitzer less than three hundred meters distant, the sight shank is shoved all the way down and fire at will employed. The light howitzer projectile is set at "red mark," which causes it to burst just in front of the muzzle. The short limit of the time fuse of the gun is two hundred meters, for the howitzer projectile it is three hundred meters. For very close or immediate defense, therefore, grazes in front of the advancing target are sought when firing with the light gun.

Against moving targets, the initial range for effect is chosen in accordance with observations during adjustment. Against an advancing target it is not necessary to verify the short limit of the bracket unless there is reason to believe that the target has advanced beyond a previously determined short limit. Volley fire is commenced at the range which is considered as most satisfactory when taken in connection with the bracketing ranges. Increments or decrements in range vary according to observations, the speed and the direction of the target. If the target ceases to move, procedure is the same as against stationary targets. If observations are doubtful, a new bracket is obtained.

If a target is expected to appear at a certain point of the terrain, it may be advisable to register this point of the terrain, immediately opening fire for effect with volleys when the target arrives at the point.

Firing With Time Shell.

A bracket is obtained in the same manner as with time shrapnel, but a one hundred meter bracket is obtained against all targets.

Fire for Effect. Due to the smaller effective depth of the time shell, bursts must be about fifty meters nearer to the target than for shrapnel. The initial range for effect is therefore only fifty meters less than the short limit of the bracket. Volleys or salvos are used. Beginning with this initial range for effect, the range is now increased by seven successive increments of twenty-five meters each until the outer limit of the original one hundred meter bracket is reached, unless observation shows that this last or any other shorter range will be ineffective. If during adjustment, the position of the target within the bracket is accurately determined, the initial range for effect may be any one of the successive ranges.

Time shell is used against targets under close protection of cover, as, for instance, troops in trenches, howitzers or mortars in pits or behind precipitous masks, living targets on steep reverse slopes, or behind walls or embankments, in ditches or sunken roads, and the like, and especially against the personnel of guns protected by shields. At longer ranges a satisfactory effect against the personnel taking full advantage of the cover of shields or against properly entrenched observing stations can be obtained with the time shell only, and even then an adequate supply must be available. Against batteries unlimbering or preparing for action or against observing stations in the act of intrenching themselves, the best success is promised by a sudden attack with time shrapnel.

On account of the great effective width of the howitzer unit projectile both as time shrapnel and as time shell, its fire should be more distributed and not too close to the flanks of the target. A howitzer battery can satisfactorily cover a target of twice the battery's front. This is a great advantage in firing upon targets whose lateral limits are unknown or not distinctly defined. If a particular range has been observed as satisfactory, which is the case when the bursts short and over are about equal, fire for effect must also be delivered at ranges twenty-five meters shorter and twenty-five meters greater than this range. If after walking through several times, observations at any two ranges differing by twenty-five meters give both short and doubtful bursts at each one

of these two ranges, all shorter ranges are at once eliminated. In the same way if only overs are observed in addition to doubtful bursts, all longer ranges are at once eliminated. In place of the ranges thus eliminated, the corresponding longer ranges must be included in the first case and the corresponding shorter ranges in the second, unless previous observations show this unnecessary. Under certain circumstances it may also be advisable to determine a new bracket. If after walking through several times, only doubtful bursts are observed at certain range and no conclusion can be formed as to the position of the bursts with respect to the target, the bursts should be temporarily lowered, especially for those ranges that will probably be target or over.

Against masked targets, such as artillery behind a crest, troops on steep reverse slopes, or behind embankments or other works, and the like, where shrapnel is more or less ineffective, an appropriate zone is swept with time shell. In searching this zone the even one hundred meter ranges are first successively fired, then the fifty meter ranges and finally the twenty-five meter ranges. As with shrapnel time fire, it may sometimes be advisable to lower the bursts to prevent overshooting a target which is very far below the crest.

Changing From One Kind of Fire to Another.

A change from time shell to time shrapnel fire is made, for example, when troops in entrenchments are observed to move or to line the trenches, or when movement is seen or suspected in a battery. In such cases the initial range for time shrapnel fire is fifty meters less than the shortest range in the previous time shell fire for effect. After this, the range is increased first fifty then one hundred meters unless observation shows this to be unnecessary. If during time shell fire, the most effective range has been determined, then the most effective range for time shrapnel fire is fifty meters less.

In passing from percussion to time fire, if the proper regulator (corrector) is unknown, it is best to at once proceed to adjust with time fire, trying for the proper bracket from the very start. If, however, the proper regulator is known or was previously determined, it is best to pass directly to time fire by using as an initial range for effect, for shrapnel one hundred meters less and for shell fifty meters less than the most effective percussion range.

A temporary change from time shell to percussion fire (shell in preference to shrapnel) is advisable in combatting batteries at not too great a range that are also plainly visible. To assure any success conditions of terrain and of observation must be favorable. Based upon previous firing, a fifty meter bracket is obtained with one gun, and percussion fire then continued as will be later described.

In passing from time shrapnel to time shell fire, the initial shell range is fifty meters greater than the previous initial shrapnel range. Seven successive ranges differing by twenty-five meters are then fired unless observation shows some of these to be unnecessary. If the most effective time shrapnel range has been determined, then time shell fire for effect is at the ranges twenty-five, fifty and seventy-five meters greater.

Percussion Fire.

Percussion fire is employed: (a) At batteries that are plainly visible and at not too great a range, in order to destroy the matériel by direct hits; (b) to destroy strong artificial cover, such as stone walls, buildings, bridges, and so forth, also used against buildings for incendiary purposes; (c) for firing at ranges beyond the time limit of the fuse, that is for the light gun beyond five thousand three hundred and fifty meters or less than two hundred meters, and for the howitzer beyond five thousand three hundred meters; (d) against troops in villages or in forests; (e) the light howitzer when using zone fire with delayed action against standard field works or bomb proofs; (f) when our own infantry has arrived in the immediate front or vicinity of the target.

If time fire was previously used, it may be sufficient merely to lower the regulator (corrector) sufficiently and also make an appropriate change in the range. The effect of the percussion shell is greater than that of the percussion shrapnel, except with the light gun against stone walls or strong masonry against which the percussion shrapnel is more effective. But against such obstacles, the howitzer unit projectile with delayed action is superior. Against bomb proofs or field works, good effect can be obtained only by setting the howitzer projectile as shell with delayed action, using zone fire.

When ranging with percussion fire, a fifty meter bracket is first obtained by using one gun. If during bracketing, any of these

single shots are lost, an appropriate change in range should be made. If the impact explosions of single shots are not sufficiently distinct, adjustment should be made by concentrating the fire of several guns using volleys. Fire for effect is begun by volleys or continuous fire at the mid range of the bracket or at one of the other limits of the bracket if previous observation justifies it. When firing over friendly troops near the target, fire is always opened at the far limit of the bracket. Changes in range of twenty-five and fifty meters are then made, until the shorts and overs at a range are equal. This is then the most effective range. If in continuing the fire at this range the proportion changes, an appropriate change in range must be made. If this change exceeds fifty meters on either side of the former limit of the bracket, it is best to determine a new bracket.

Troops in deep formations (troops in woods or villages) are kept under fire by searching with successive ranges differing by fifty milometers. The initial range then is usually the far limit of the bracket. Against targets nearer than the short limit of the time fuse of the gun, fire at will is used, sights being shoved down and the projectiles burst on impact in front of the target.

In using the howitzer unit projectile as shell with delayed action, a two hundred meter bracket is first obtained with one gun, using the full powder charge (flat trajectory, our third zone). At this mid range of this bracket zone (curved) fire is begun, and this is continued until the fifty meter bracket is determined. The procedure after this is as with the gun, except that instead of volleys or continuous fire, salvos of two or three shots are fired until the most effective range is determined. At this range fire for effect with delayed action is employed, using either volley fire or continuous fire with short time intervals. This range may be increased in those cases where it is surmised that there is additional cover in rear of the first line of cover.

Firing Against Instantaneous Targets.

By instantaneous targets are meant such targets as will expose themselves to a successful attack for a brief period only. Examples of such are staff groups, batteries in the act of unlimbering or preparing for action, dismounted cavalry, very rapidly moving targets, infantry skirmishers rapidly advancing over a registered zone, flank targets which are likely to disappear quickly, and at

night targets that are illuminated for a short time by searchlights, etc.

Against very small targets (staff groups, etc.) no bracket is attempted. The battery will usually be in a position in observation and have registered prominent points. Under such conditions if the battery commander has properly reconnoitered his sector, a fair estimate of the range can be made. According to the chances for accuracy in this estimation, echelon fire is opened, the three platoons or the six guns firing a simultaneous volley, the ranges between the platoons or guns differing by one hundred meters. Only one range is given in the command, which range is taken by the center platoon in echelon fire by platoon, or by the fourth gun in echelon fire by piece. Several volleys are usually fired in rapid succession, without trying to observe the effect. The regulator should be so chosen as to prevent grazes, but on the other hand very high bursts should also be avoided.

Against wide targets, it is advisable to quickly obtain a rough bracket (for instance, against a battery that has just advanced to unlimber, a two hundred meter bracket is sufficient). Fire for effect is then opened by dropping back one hundred meters and then walking through by increments of one hundred meters without waiting to make changes on observations. If the terrain has been so registered that a reliable estimate of the range can be made, bracketing may be omitted and fire for effect opened at once. This procedure would be advisable against an infantry or accompanying battery which is advancing to take up a position near some point past which the attacking infantry had previously advanced.

Firing Against Captive Balloons and Searchlights.

During adjustment the bursts should be on line with the target, but during fire for effect normal bursts above the target are desired. In bracketing, volley fire with time shrapnel is used, changes in range being from six hundred to one thousand meters. If the longest range of the time fuse (five thousand three hundred fifty meters for the gun, five thousand three hundred meters for the howitzer) is used for the first volley in order to determine from the very beginning whether the target is within the time fuse of the gun. Further firing is then usually carried out in the same manner as against stationary targets. If the range is known (that is

obtained from a map or by a range-finder) the target should be attacked as an instantaneous target.

Firing at Aircraft.

Against large aircraft traveling at ordinary speed, a wide bracket (from five hundred to one thousand meters) should be obtained using volley fire. Fire for effect is then delivered by volleys, guns being echeloned in range from one flank to the other. Several successive volleys at different ranges may also be ordered from the very start. Accurate observation will seldom be possible. If changes are made, they should be based upon the direction and speed of the target as well as previous observation. If aircraft is seen to be ascending or descending, a corresponding change in the corrector must be made. If the actual range is more or less unknown, the first volley in echelon fire should be so ordered so that the longest range of the echelon will be the longest range of the time fuse. Against airships or aeroplanes flying at great speed, zone fire is used without previously determining a bracket.

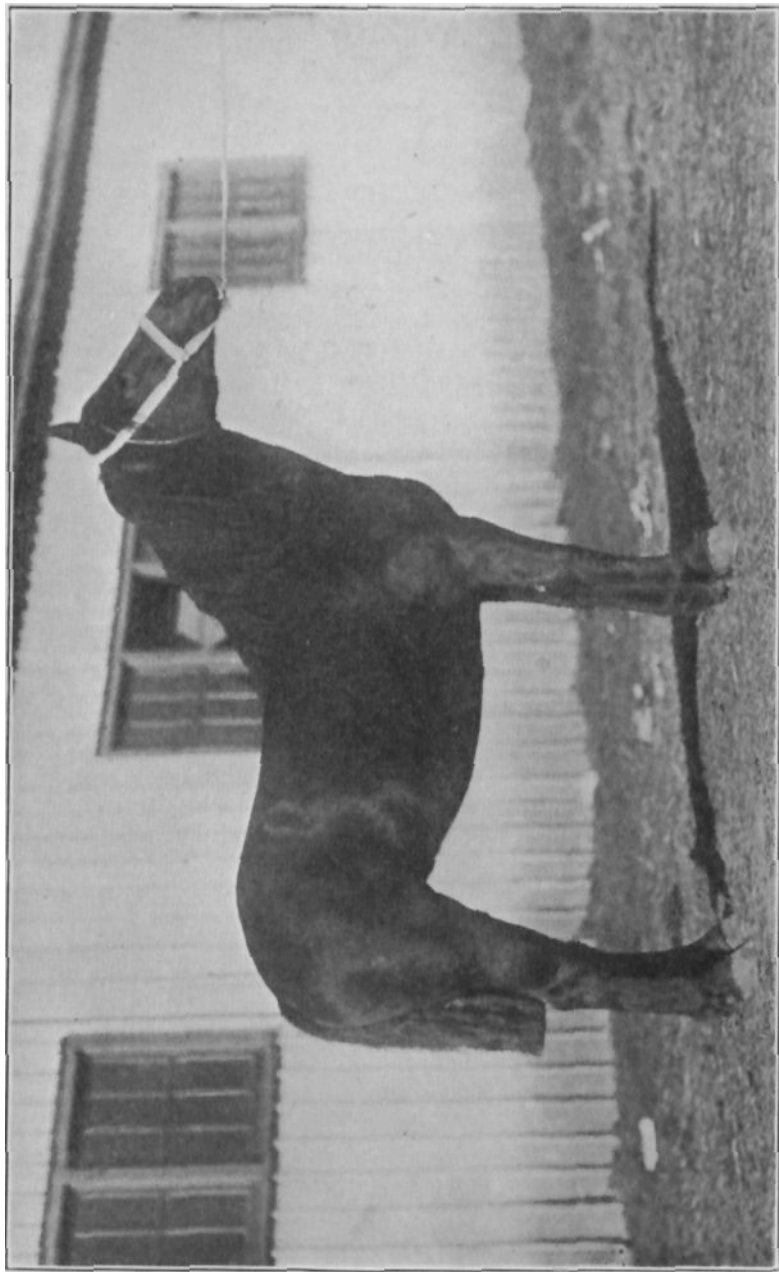
Night Firing.

If the sector is illuminated by searchlight, the method in attacking such targets as are within the field is the same as for firing at day.

When no searchlights are available, all preparations for firing must be made before darkness sets in. A single gun may be placed in position and laid, or all firing data may be obtained with the aiming circle or scissors instrument. All data is carefully noted on a panoramic and outpost sketch, all zones being lettered, and targets, registration points, reference points, etc., plainly marked. The instruments should then be accurately laid upon the target or reference points. Auxiliary observers must be used. Several copies of the sketches are made and distributed to the battery and observers. The night gun positions may be marked by a long white cloth band with two short cross pieces (position of axle and wheels).

If no preparations can be made during daylight, then only such targets as show or reflect some light may be successfully attacked, and then auxiliary observers are absolutely necessary. With the assistance of the auxiliary observers a wide bracket is determined. This is then searched by successive volleys differing by one hundred meters. With the aid of the auxiliary observers, ineffective ranges are eliminated.

(TO BE CONTINUED)



FRENCH FIELD ARTILLERY REMOUNT PURCHASED IN THE UNITED STATES.

Two thousand field artillery remounts were purchased by the French government from the Southern Stock Yards Corporation, Richmond, Virginia, during November, 1914. This illustration shows a typical specimen—a black mare, six years old, fifteen hands two inches tall, weighing thirteen hundred pounds and extremely active and intelligent. The exact price could not be ascertained, but it is believed not to have exceeded \$175.00.

HOW THE COMMANDING OFFICER OF A FRENCH LIGHT FIELD ARTILLERY BATTALION EMPLOYS HIS BATTALION ON THE BATTLEFIELD.

(FROM CONTEMPORANEOUS NOTES)

As the French field artillery drill regulations give only general rules concerning the battalion in combat, it is doubtful if many of our officers know how a major handles his battalion on the battlefield. The method here described is not followed by all battalions of French light field artillery; for, although the spirit of the regulations is always carried out, two battalion commanders placed in almost identical situations have employed somewhat different methods. We here attempt to describe a method that has been successfully employed during the present war.

ORGANIZATION OF THE BATTALION.

In order that our readers may more readily follow us, we will give in detail the organization of the battalion, which consists of three batteries and the battalion staff.

On a war footing a battery is divided into nine sections, each commanded by a *maréchal des logis* (sergeant), aided by two or more *brigadiers* (corporals). Each of the first four sections consists of one cannon and one caisson; the fifth section of two caissons; the sixth and seventh sections of three caissons each; the eighth section of the forge, the battery wagon, and the led teams; the ninth section comprises the wagons forming part of the regimental train and are: one large wagon for forage and three *fourgons* (small covered wagons) for rations. The first five sections constitute the firing battery which is commanded by the lieutenant of the active army, the sixth and seventh and eighth sections, the battery combat train, commanded by the lieutenant of the reserve.

The following table shows how the battery is divided into its different sections:

Officers—1 captain, 1 lieutenant of the active army, 1 lieutenant of the reserve.

Rank of the Personnel	Number of the Sections									Total
	1	2	3	4	5	6	7	8	9	
<i>Adjutant-Chef or Adjudant</i>				1 ¹						1
<i>Maréchal des logis Chef</i>		1								1
<i>Maréchal des logis, Mechanic</i>					1					1
<i>Maréchal des logis fourrier</i>								1		1
<i>Maréchaux des logis</i>	2 ²	1	2 ³	1	1 ⁵	1	1		2 ⁴	11
<i>Brigadiers</i>	2 ⁶	2 ⁷	1	1	1	1	1	1	2	12
Trumpeters	1		1 ⁸		1 ⁹		1			4
Mechanics					2	1	1			4
Saddlers.....							1		1	2
<i>Aides-Maréchaux, mounted</i>				1 ¹¹						1
<i>Aides-Maréchaux, dismounted</i>								1 ¹³	1 ¹³	2
Horse shoer, chief.....							1			1
<i>Infirmier</i> (Hospital corps man).....							1			1
Litter bearers							4			4
Cannoneer	5 ¹⁰	5 ¹⁰	5 ¹⁰	5 ¹⁰	3 ¹¹	7	1	1	12	44
Drivers, mounted.....	6	6	6	6	6	9	9	12	4	64
Drivers, dismounted	1 ¹²	1 ¹²	1 ¹²	1 ¹²	1 ¹²	1	2	4	4	.....
Total (men).....	17	16	16	16	16	20	21	22	26	170
Horses { Officers'.....		1	2		1					4
{ Saddle.....	5	4	4	4	4	2	18	24	9	32
{ Team.....	12	12	12	12	12	18	18	24	9	129
Total (horses)	17	17	18	16	16	21	21	27	12	165

- Chief of 2nd Platoon.
- One is Chief of 1st Platoon.
- One is agent of communication.
- One is assistant to supply officer of the battalion.
- Scout, the chief mechanic commands 5th section.
- One is the "*brigadier de tir*," he is also assistant to the Company Clerk (*Maréchal des logis fourrier*).
- One is a scout.
- For either the Major or Lieut. Col.
- Scout.
- At least one is a master pointer.
- One for the B. C. telescope and 2 as signalers and telephone men.
- These drivers perform the duties of Nos. 4 or 5 in the gun squad. In the French Artillery cannoneers are not always trained as drivers, nor are drivers trained as cannoneers except in the duties of Nos. 4 and 5.
- These men correspond to our farriers.

The Battalion Staff.

- 1 Major commanding the battalion.
- 1 Lieutenant of the active army, assistant.
- 2 Lieutenants of the reserve, assistants.
- 1 Supply officer.
- 1 Medical officer.
- 1 Veterinarian.
- 7 Orderlies for the above officers, only one of whom (the major's) is mounted.
- 1 Non-commissioned officer, assistant to medical officer.
- 1 Corporal, chief of litter bearers.
- 1 Cyclist.
- 1 Butcher.
- 6 Drivers.
- 8 Riding horses.
- 11 Horses for carriages.
- 5 Carriages, viz., 1 medical cart (1 horse), 2 *fourgons* (2 horses each) for baggage, 1 wagon (2 horses) for meat, 1 carriage for battalion commander's observation ladder (4 horses).

A total of 7 officers, 18 men, 19 horses and 5 carriages.

The battalion commander also has a personal mounted musician furnished by the 1st battery of his battalion.

On the march the assembled battery combat trains march in rear of the three firing batteries. They are under the command of one of the reserve lieutenants listed in the battalion staff above, the other lieutenant of the reserve being agent of communication between the battalion commander and the lieutenant colonel.

The Headquarters Detail.

From the organization of the battalion staff given above it would seem that a major has not many mounted men with him during his reconnaissance. But by consulting the table for organization of the battalion we see that several sections in each battery contain extra men for agents, scouts, etc. This detail is organized as follows:

- 1 Reconnaissance officer, a lieutenant of the active army.
- 4 Agents of communication, one sergeant per battery and one sergeant for the battalion combat train.

9 Scouts, 1 sergeant, 1 corporal and 1 trumpeter for battery.

1 Personal trumpeter furnished by the 1st battery.

1 Cyclist.

The following order of march for the detail was always adopted:

Reconnaissance Officer,	÷	±	B.C.		
Sergeant scouts,	=	=	=	× Agent of communication, 1st battery	
Corporals,				× Agent of Communication,	
Trumpeters,	Patrol	{ - 1st	{ - 2d	{ - 3d	× Agent of Communication,
		{ +	{ +	{ +	× Agent of Communication,
					3rd battery
Battalion Commander's personal trumpeter,			+	×	Agent of Communication, Combat trains.

The reconnaissance officer marches on the major's left and never in rear of him. The agents of communication are in rear of each other in the order of march of their batteries. The senior sergeant scout is known as chief of scouts and generally marches in rear of the reconnaissance officer. The corporals and trumpeters are divided into three patrols and are numbered from left to right, as indicated above, the first patrol furnishing route markers Nos. 1 and 2, the second patrol, markers Nos. 3 and 4, and so on. The cyclist seemed always to be several yards in front of the major.

Order of March of the Battalion.

On the road the battalion marches as follows: The staff, as indicated above; the captain of the first battery ten meters in rear of the staff; the first battery ten meters in rear of its captain; the two remaining batteries follow at distances of twenty meters measured from the rear of the last carriage of a battery to the heads of leading team of the following battery; the battalion combat train, thirty meters from last battery with distances of about fifteen meters between the trains of the different batteries. In each battery the lieutenant marches on the left of the captain; the battery headquarters detail, viz.: the "*brigadier de tir*," the battery agent of communication for the combat train and the trumpeter march with the caisson of the first section; the *maréchal des logis chef* (this non-commissioned officer corresponds somewhat to our first sergeant) marches in rear of the firing battery.

The battery combat trains march in the order of their batteries. The medical cart and personnel enumerated in the battalion staff

above march at the rear of the combat train. The orderlies of the battalion staff, except that of the supply officer, are with the combat train of the first battery. The major's orderly rides his (the major's) spare horse, but the others not being mounted find places on the different carriages. There seemed to be no place prescribed for them; they found a seat wherever there was one vacant. The veterinarian marches at the rear of the combat train.

The battalion commander's observation carriage seemed to be always the leading carriage of the first battery while on the march. In the batteries the fifth section is usually at the rear, but I have seen the first caisson of this section take place at the head of the battery upon forming and preparing for action.

Reconnaissance of the Position by the Battalion Commander.

The battalion is marching in the direction of the enemy in the order above described when its commander receives orders to report to the lieutenant-colonel of the regiment for reconnaissance. The agent of communication for the battalion combat train is at once sent to its commander with orders to separate the train. While passing, this agent repeats his orders to the battery commanders. Before departing the major directs the captain of the leading battery to have the batteries continue at the trot and the captains follow in five minutes at the gallop. Each captain commands, "Reconnaissance," upon which he is joined by his headquarters detail, viz.: *Maréchal des logis chef*, *brigadier de tir* and trumpeter, his battery combat train agent of communication reporting to the lieutenant commanding the train of his battery. The captains of the two rear batteries with their details then join the captain of the leading battery in order to be at the head of the battalion to follow the major at the time designated, or sooner, should orders be sent back to that effect.

The battalion commander with his detail having departed for reconnaissance, his lieutenant assistant (our reconnaissance officer) causes the route to be marked by members of the patrol. So well are these men trained that this work seemed to be done automatically; the battalion commander never intervenes and his assistant rarely ever. The senior sergeant scout (generally known as chief of scouts) calls out, "First marker," and points towards the place where the man thus called is to remain. As soon as a marker's

number is called by the sergeant, he at once looks towards him for a sign as to whether he is to ride up by the side of the sergeant to receive a message or to fall out at once and mark the routes. Long messages are never given them; in fact, they often receive no message, in which case they fall out and remain with their right hands pointing in the direction to be followed until the first battery arrives, when they rejoin the major's headquarters. In this battalion a marker never replaced the one following, but always joined the headquarters upon the completion of his duty. In case the sergeant did not properly mark the route, the lieutenant intervened. It was observed that his chief of scouts was inclined to employ too many markers rather than too few. The marker nearest the position to be occupied always told the captains and the lieutenant temporarily commanding the battalion that he was the "last marker," in order that they might know of the nearness of the position.

The battalion commander learns from the lieutenant colonel his mission and the terrain assigned to him. He then rides his terrain in order to observe the panorama to be seen from different points of his line, especially the extremities. He decides at once the number of batteries to be put into action and the mission assigned to each, the position and defilade of each battery being determined by its mission. He seems to make no effort to conceal himself from the enemy, but with his reconnaissance officer by his side, rides rapidly the crest line of his position from end to end. The headquarters detail, however, keep well under cover, but all, especially the agents of communication, pay close attention and respond at once when the number of their batteries are called. This part of the reconnaissance accomplished, the battalion commander then rides the position in the opposite direction, this time in rear of the crest, marking the position of each battery by the corresponding agent of communication.

The positions are often only approximate, but the less the defilade the more exact the determination of the position. For great defilade, however, not much time is devoted to the determination of the exact position of the guns, as a few meters more or less in advance does not make much difference.

The battalion commander endeavors to devote to each battery the time necessary and no more; for the one whose defilade is to be

greater than that of a mounted man, he is satisfied with finding the position approximately, while for that one whose defilade is to be equal to that of a dismounted man he takes great pains. He once stated: "The art of an artillery commander consists in devoting to each unit a proportionate part of his total time of reconnaissance, depending on the mission assigned to the unit, and to make his total time of reconnaissance no longer than that required for his command to march at the most rapid gait practicable (trot or trot and walk, depending on the distance) the distance which separates the position from the point where he left his command. As soon as the artillery is called upon to assist the infantry not one minute should be lost in useless reconnaissance."¹

The agents of communication are so posted as to indicate the manner of going into action and the direction of the fire. If their horses face the crest perpendicularly the batteries occupy the position from line, if their horses are parallel to the crest, the batteries approach by the flank and in the direction which the horses face. If the agents are on foot the drivers and all mounted men dismount before taking up the position. Their right hands point in the direction of fire. The battalion commander indicates to the agents his reference point or points, which he has selected while riding the crest line. It is not always necessary that the agent see this point; the battalion commander directs him about as follows, "Tell the captain to advance towards the crest in the direction of that large boulder (pointing it out); he will see a farm; the chimney on house farthest to the right is the battalion commander's reference point."

The major then goes to his station which he has chosen during the first part of his reconnaissance, from which he can observe his field of battle, nothing more. He dismounts and turns his horse over to the trumpeter, who remains concealed from the enemy, but in a position where he can be easily seen by the captains when they arrive.

¹ So far the infantry has never had cause to complain of its light artillery. The French Infantryman has nothing but praise for the work of his "good cannon of 75." During the battle of the Marne the Germans were throwing a bridge across the river and the French infantry, not being able to prevent it, began to say. "If our artillery was only here." But the "good cannon of 75" was watching and a few melinite shells were shortly seen exploding among the pontons.

Reconnaissance by the Battery Commanders.

While the above is going on the three captains are approaching with their details, having left the battalion at the time designated. They follow together the route marked until they reach a marker who calls out "last marker." They then know that they are near the position and look for their respective agents who have been posted by the major, as indicated above. Each captain then rides towards the agent carrying the color indicating his battery. The *brigadier de tir* and the trumpeter are substituted for the battalion agent, the former being placed on the flank by which the battery is to enter, on the right, if position is to be occupied from line. The trumpeter is placed at a distance from the *brigadier de tir* equal to the front to be occupied by the battery, which depends upon the defilade, the less the defilade the greater being the front. In some batteries these agents are so well trained that they substitute themselves for the battalion agent without any assistance from the captain, taking an interval between themselves so as to have twenty or twenty-five meters between each section if the defilade is greater than that of a mounted man. If the defilade is less than that of a mounted man a greater interval is taken. The captain quickly selects his observation station, indicates it to the *brigadier de tir*, and gives the order to run a telephone line from the battery to the station, should it be necessary. This done, he rides to the point marked by the battalion trumpeter, dismounts, turns his horse over temporarily to the agent of communication of his battery, and then reports to the battalion commander.

*Posts to be Taken by the Members of the Headquarters Detail
Upon the Accomplishment of Their Duties.*

The agents of communication, as soon as relieved by those of the captains, join the trumpeter, dismount, and hold themselves ready to carry messages. The members of the patrols also join the trumpeter as soon as they have indicated the route to the batteries. The reconnaissance officer generally sends a patrol out on one or both of the flanks and designates one to hold the horses of the agents of communication in case the routes from the battalion to the battery commanders' stations do not afford concealment for a mounted man. The three sergeant scouts always keep under cover

within calling distance of the reconnaissance officer. While the horses of the major, the lieutenant and the three sergeant scouts are always held under cover near the battalion commander's station, the horses of other members of the headquarters detail are generally sent to the position of the limbers.

Advance to and Occupation of the Position by the Batteries.

We will now return to the batteries which we left marching on the road in section column under the command of the lieutenant of the leading battery. They continue at the trot or trot and walk (field artillery rarely ever gallops) until they leave the road and began to march across country, when line of double section column is formed if the terrain permits. The three lieutenants now finding themselves at the head of the column, the senior assumes command.

The marker nearest to the position calls out "last marker" to the senior lieutenant, who gallops forward a hundred meters or more to see what has taken place. If he sees that the captains have posted their agents, he releases command of the battalion and each battery goes direct to its position. From the manner in which the agents are posted the lieutenants know all that is necessary for putting the batteries in action. The *brigadier de tir* indicates to the lieutenant the reference point of the battalion commander and the battery commander's station where the fifth caisson is sent. The caisson is provided with an observation ladder and shield for the battery commander. The battalion commander's observation carriage, which is generally at the head of the leading battery, goes direct to the place marked by the battalion trumpeter.

If, when the battery is in position, the captain has not returned to his post, the lieutenant forms the sheaf, putting the directing piece on the battalion commander's reference point. He causes the least range for clearing the crest to be marked on the shield of each piece.

When the captains reported to the major, the senior *maréchal des logis chef* of the battalion reported to the reconnaissance officer for instructions as to the position of the limbers, which is often the same as that of the combat train. The two other *maréchaux des logis chef* with their limbers follow those of the senior.

Each battery trumpeter takes the horses of his captain and *brigadier*

de tir and leads them to the vicinity of the limbers. Horses are rarely ever held near the position of the guns.

The Combat Train.

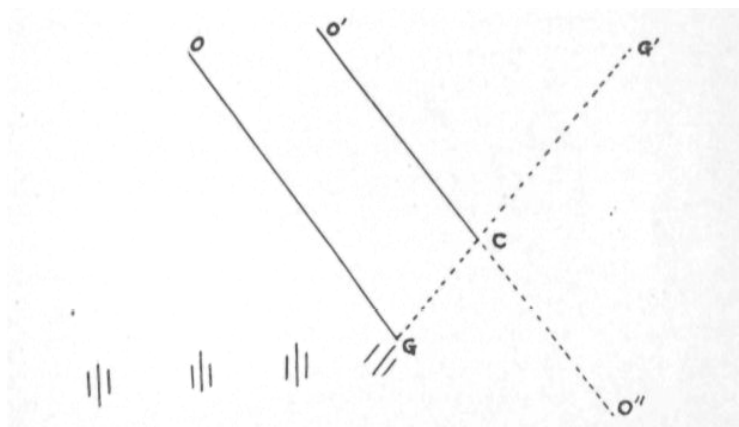
When the combat train commander received orders to separate his command, the batteries were in column of sections, and the head of the train was therefore more than five hundred meters from the head of the column; consequently, he continued to keep his distance of thirty meters until the battalion formed a line of double section columns, when he increased the distance to between five hundred and one thousand meters. The battalion commander does not occupy himself with the combat train after giving the order to separate it. It then becomes the duty of the train commander to follow in the trace of the batteries and never to lose this trace. If necessary, several mounted men under a noncommissioned officer are sent forward as connecting files. When the battalion forms a line of double section columns, the train generally forms a line of section columns, or double section columns. Seeing that the batteries are about to go into action, the train commander halts the train and searches for a suitable position, which should fulfill the following conditions: First, concealed from the enemy; second, out of range of artillery fire directed against the batteries; third, from which caissons can be easily sent forward to the batteries; fourth, near a road in order to have easy access to the ammunition train of the corps. Having posted his train, he sends the battalion agent of communication to report to the major, and the battery agents to their respective captains. If signals from the batteries cannot be seen from the position one or more men are posted so as to relay them.

Method of Laying for Direction.

The captains having received their instructions, return to their station and lay their directing pieces on the reference point of the battalion commander. The method shown in the following illustration is most generally employed.

As soon as the directing piece is in battery, its gunner at once looks towards the B. C. station, and when the captain faces him and says, "On me," he lays directly on the line of buttons of the

captain's coat with the sight at zero deflection. It is not necessary that the gunner be able to hear the captain, for when the latter faces him standing perfectly still it is the moment to lay the gun. Without disturbing the direction of the piece, the gunner then turns his sight on an aiming point indicated by the lieutenant and looks at the reading. From the figure it is seen that the deflection desired is the angle $O G C$, O being the object and C the captain ($O G C = O' C G' = G C O''$). Consequently, the captain measures the angle $G C O''$ between the sight of the directing piece and an object O'' on $O' C$ prolonged, $O' C$ being parallel to $O G$. To



measure this angle, he uses either the scale of mils in his field glasses or his hand. This angle being, say 230 mils, he then commands, "Add 230." The gunner adds this to the reading of his sight, calls this reading off to the lieutenant and lays his piece. The lieutenant then gives a command, which being freely translated is as follows:

"Aiming point, telegraph pole to right; deflection, 1350; increase by 15." The pieces being put in direction by means of the aiming point as indicated, each gunner directs his sight on a stake that his chief of section has caused to be set up 50 yards or more in front of his piece. Had the aiming point been directly in rear the deflection difference would have been the parallax of the same plus 15 mils. Instead of using an aiming point reciprocal pointing is often employed.

If the captain has not returned from the battalion commander's

station when the battery is in position, the lieutenant runs forward until he can see the reference point and gives the direction to the directing piece. It must be remembered that the French have no telescopic sight; their apparatus turns through a complete circle as does ours, but during the fire each gunner must have an aiming point to the front and not far off his line of fire. Sometimes the gunner selects a small brush on the covering crest, but very often it is necessary to place a stake fifty yards or more in front of the piece.

Method of Communication.

Every battery has two telephones and one hand reel containing five hundred meters of wire. In the limber of the battalion commander's observation carriage there are four telephones and two hand reels, but the major always calls on one of the batteries to lay him a line if he has need of it. He seems never to employ his own detail and equipment for this purpose; in fact it is doubtful if the battalion details have been instructed how to employ the telephone. However, all the members of this detail are very efficient in signalling.

The telephones do not work very well, due to three reasons; first, bad phones; second, only small buzzer wire is employed; third, the men are not properly instructed. Consequently the battalion commander selects, if possible, a station between two of his batteries and causes their captains to place themselves near him. With his third captain he communicates by signals or sends messages to him by the corresponding agent of communication. The captains generally run a wire to their batteries, but depend largely upon signals for transmitting their commands. The signals are very simple and necessitate no flags. Some of them are: Add, signal for trot; subtract, signal for walk; zone fire (*tir progresif*), signal for gallop, made with both hands.

Rôle of the Battalion Commander During the Fight.

To assign each battery its object, to control the efficiency of the fire and to cause the fire to be opened at the proper time is the rôle of the battalion commander during the fight. By controlling the efficiency of the fire it is not meant that he interferes with the battery commander in the firing of the battery. Far from it. Conduct

of fire is exclusively the rôle of the battery commander. But by rectifying certain errors regarding the objective and ordering modifications in the mission of the different batteries as a consequence of changes in the situation, he may greatly increase the efficiency of the fire. For example, when the captains reported to him as stated above he designated the left and center batteries as counter batteries and the right as an infantry battery. If the patrol that he sent out on his right flank reports that he can see hostile artillery in position in rear of a crest and if this hostile artillery can not be seen from his station he would at once change the designation of his two flank batteries. The captain of the right battery, if he could not see the target from his present station, would move towards his right until he could see the hostile artillery, and take it under fire.

The battalion commander observes closely his battlefield and takes advantage of every opportunity to take his adversary by surprise. He often finds that an enemy invisible from one battery commander station is visible from that of another. In such a situation he would not hesitate to change the mission of his batteries.

Objectives are generally designated as being so many miles right or left of the reference point. For instance, to the captain at some distance from him, he would signal a message as follows: "L—80—I—100," which means: "To the left of reference point 80 mils, a line of infantry whose front is 100 mils."

Methods of Fire Used by the Batteries.

Inasmuch as the French employ methods somewhat different from ours in their fire for effect, we will now follow each of the three captains in the execution of their tasks. The major designated the battery on the right flank as an infantry battery with mission to fire only on hostile infantry appearing within the limits assigned to the battalion. The other two batteries are counter batteries.

The advance guard battalion having been in action for several minutes the hostile artillery begins to reveal itself and the major of our battalion says to the captain of the left battery, "Left 90 flashes of artillery." Ninety mils to the left of the battalion commander's reference point the captain distinguishes the flashes of six guns on a front of about sixty mils. He does not change his sheaf, but shifts it ninety mils to the left and ranges on the crest behind which he saw the flashes.

His commands are as follows:

<i>Commands</i>	<i>Sense</i>
Add 90	
Angle of site +5	
Corrector 18	
By battery from the right:	
3200	S
3600	L
3400	S
3500	L
By three, sweep:	
3400	
Corrector 16	
3450	
Corrector 14	
3500	
Shell:	
By battery from the right:	
3600	S
3800	L
3700	L
3750	L
3725	L
3700	L
3675	L
3650	L
3625	S
Add 5	
By two, sweep:	
3750	
3725	
3700	
3675	
3650	
3625	
Subtract 10	
3750	

<i>Commands</i>	<i>Sense</i>
3725	
3700	
3675	
3650	
3625	

If the fire of the hostile battery does not materially slacken, the captain knows that it is further in rear of crest than he has searched; for any battery within 150 yards of the crest would have lost more than one third of its personnel by the above shell fire. He would then execute a similar fire beginning at 3850 and decreasing by twenty-five yards until he reached the range 3750.

A second hostile battery unlimbers in the open and the major directs the commander of the center battery to destroy it. This he proceeds to do and commands as follows:

<i>Commands</i>	<i>Sense</i>
Subtract 120	
Angle of site +10	
Corrector 18	
By battery from the right:	
3000	S
3400	L
Corrector 20	
Zone fire, sweep:	
3000	
Diminish by 5	
Shell:	
By battery from the right:	
3400	L
3200	S
3300	S
3350	L
By two, sweep:	
3325	
3350	

First piece only at my commands;

Fourth piece at the commands of the lieutenant.

<i>Captain's Commonds to 1st piece:</i>	<i>Sense</i>
3350	L
Add 5	
3350	L
One turn right	
3350	L
3350	L
3325	L
3325	S
3325	L
3325—hostile piece destroyed.	

The lieutenant takes the fourth piece and proceeds in a similar manner to the destruction of the hostile pieces beginning with the right of the battery, the captain having begun with the enemy's left piece.

The method employed by the infantry battery against hostile advancing infantry did not differ much from ours, except when the enemy entered a dead space in front of the battery. The minimum range for clearing the crest being eighteen hundred meters, the captain continued to give ranges down to fourteen hundred meters. On the shield of each piece is always written the minimum range for clearing the crest and every Number 1 is instructed never to give his piece a less elevation. Consequently when the captain ordered a range less than that for clearing the crest every Number 1 sets his gun at the range marked on his shield and keeps it at this elevation until a greater range is announced by the captain. The fuze cutters, however, cut their fuzes at the ranges ordered.

Although, as noted above, the method of attacking an infantry target is similar to ours, it differs considerably in the kind of ammunition employed. Whereas in our own service we consider shrapnel as the typical ammunition to use against infantry, the French very often use high explosive shell for this purpose.

It must be remembered that, upon mobilization for the present war, all French light batteries and ammunition columns for light artillery carried equal amounts of shell and shrapnel. Consequently French battery commanders have frequently been compelled to employ shrapnel against infantry when they would have preferred to use shell. Knowing that the different echelons of the ammunition sections contained as much shrapnel as shell, the battery commanders

endeavored to economize on shell and often use shrapnel when shell would have better served their purpose.

Against entrenched infantry shell is always employed, as shrapnel serves only to keep the infantry in the trenches. The French artillery never fires "to keep the infantry down," but always to destroy it. For this purpose, the melinite shell is the projectile *par excellence*. Before the beginning of this war many French artillery officers made the statement that, with a time fuse, they would prefer to have nothing but shell and do away with shrapnel altogether. As cases often arise when ranging with percussion bursts is difficult or impossible, the time fuse is desired on the shell if there is to be no shrapnel.

It may be well to invite attention to the fact that the melinite shell weighs only eleven and one-half pounds, but contains twenty-nine ounces of melinite. The fuse is point-percussion, delayed action. With the flat trajectory of the French field gun this projectile, at short and mid ranges, does not burst when it first strikes the ground, but after the impact rises and bursts in air. One of these shells falling midway between two sections of a battery in action will put all the cannoneers of these sections *hors de combat*.

With this shell it is possible to destroy infantry in trenches; and as such cases will occur daily in any war, it is interesting to follow a French battery commander in his efforts to destroy entrenched infantry. The directing piece of the battery is layed on the battalion commander's reference point. The battery is covering a front of sixty miles. The captain gives the following commands:

<i>Commands</i>	<i>Sense</i>
-----------------	--------------

Add 60

Angle of Site 5

Corrector 18

By battery from the right:

3000	S
3400	L
3200	S

Shell:

3400	S
3600	L
3500	L
3450	L

By four sweep:

3400

3425

3450

The battery commander then continues to sweep the short, long and mid ranges of the bracket.

SMOKE BOMB PRACTICE

BY 1ST LIEUTENANT ROGER S. PARROTT, 3RD FIELD ARTILLERY.

Smoke bomb practice having been officially adopted as a means of instruction for Field Artillery officers, a few notes on its origin, development and practice may be of value.

The apparatus manufactured by the Ordnance Department, which we now use, is a development from that used by the Dutch Field Artillery. The idea was brought from Holland by Captain Dan T. Moore; and a bomb was made up by the school mechanics, under his direction, during the first course of the School of Fire. At first it was tried with only one smoke bomb, and a good deal of difficulty was experienced in its operation. But even in this crude state it proved such an efficient means of instruction that steps were immediately taken to extend and perfect the equipment, and a number of slight changes in mechanical construction were made based on the suggestions of the mechanics, noncommissioned officers, and officers connected with the school and of the student officers and noncommissioned officers.

In the same way the system of operation has been developed. Before its official adoption it had been taken up by several of the regiments, through their officers who had been at the school and who took home samples of the targets and smoke bombs.

About a year ago the Ordnance Department took up the manufacture of the smoke bombs, which are now issued. Not being familiar with their use, they attempted several improvements over the school model, which have not increased their efficiency.

One of the objections to the system at that time was the inability to simulate high bursts. A "smoke bomb, rifle grenade type," was devised by the Ordnance Department to provide for this. This was a rifle, firing a blank cartridge, and a steel body containing a spring plunger and having a steel stem screwed into it. The stem was inserted in the rifle barrel and a primer seated in the body, over which was then fitted a small tin can containing loose black powder. A cord was attached to the body and the other end fastened to the ground, the length of cord corresponding to desired height of burst. When the rifle was fired, the entire apparatus was shot into the air to the limit of the cord. On reaching this height the jerk on the cord operated the plunger and exploded the powder.

This apparatus was tested at the School of Fire and found to be unsatisfactory, due principally to slowness and uncertainty of operation and danger from flying fragments of tin, and its manufacture was stopped.

Its place was taken at the school by a device invented by First Class Signal Sergeant James McQuillan of the School Detachment. It consists of two iron poles, 40 feet in height. These were made from two 20-foot iron telephone poles (2-inch iron pipe), but can as well be made from three base pipes from the old Ordnance appearing

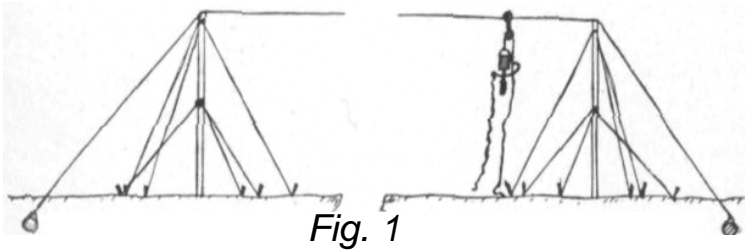


Fig. 1

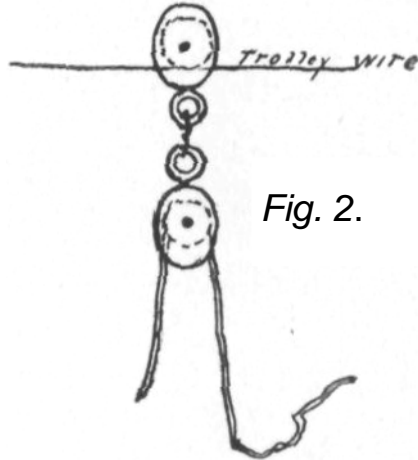


Fig. 2.



Fig. 3.

target frame. They were fastened together by an iron collar. The poles were set in the ground 100 yards apart and guyed with three wires from the top and three from the middle. A heavy galvanized wire (number 9) was stretched across the top of the poles and anchored on each end to a "deadman." Four 1-inch pulleys, such as were issued with the "Fixed and appearing target frame," run on this wire and attached to each is a second pulley over which runs a halyard attached to a smoke bomb cup. The bomb could then be raised to any height up to forty feet and placed in any position between the two poles. The only alterations necessary in the smoke bomb were a handle or bail, a small weight in place of the staff, and a forty-foot lanyard (Figs. 1 and 2).

It is used only when high bursts are desired and can be operated by the same men who handle the pole bombs. Two sets are used at the School of Fire, one in front and one in rear of targets, but one set is sufficient, as when this is used the bursts are too high to sense as short or over.

As issued, the poles of the "smoke bomb, pole type," are too long to handle easily. In connection with the installation just described, a six-foot staff may be used, which makes the bombs much easier to handle.

Most graduates of the School of Fire will admit that the smoke bomb practice in the regiments is not nearly as satisfactory as that at Fort Sill. This is perhaps partly due to the inferior apparatus, but mostly to the method of operation. A brief description of the operation at the school will, I believe, help towards a more efficient working in the regiments.

At Fort Sill the ground is entirely open, with no brush or high grass and therefore the terrain itself must be adapted to the concealment of the operators. At other places, brush, weeds or grass may assist, but as these also conceal the targets, it will be found more satisfactory to use open ground if such can be found fulfilling the requirements. A cross section of the most favorable location is shown in Figure 3.

This consists of two crests of approximately the same height, so that while the targets are visible the operators are hidden by the ground, both in front and rear.

The men are a permanent detail throughout one course, and half of them are retained for the next course, the new men being given a week's preliminary training in their work. This is an exceedingly

important point which is often lost sight of. While the bomb man has nothing to do except load his bomb, fire it when ordered and move as he is directed, it takes a certain amount of intelligence and training to do these three things quickly, accurately and safely.

A very competent noncommissioned officer, with a thorough knowledge of firing data and ability to translate it into action instantly, is placed in charge of the operation at the target. He takes his place behind one of the center targets and controls all his men from this point. The telephone operator, connected with the firing point, is at his elbow. In order to avoid the confusion of "add," and "subtract" since to the man at the targets "add" is right and "subtract" is left, the men are numbered as follows:



Fig. 4

This arrangement eliminates the "right" and "left," for "add" always runs up the scale of numbers and "subtract" runs down. For instance, suppose the interval between targets to be assumed as five mils, and Number 2 and 3 bombs have fired. The command comes down "Add five," and the operator gives the command "Numbers 3 and 4, FIRE."

The distance from targets to bombs is determined by the ground, the men being just covered from the firing point, but close enough to understand all commands of the operator given through a megaphone. If this is impossible, the operator may take his place with one line of bombs and be connected with the other line by telephone to an extra man, who will repeat his commands.

The men are seldom moved for changes in deflection, and never more than a few yards. For large changes the command is given to the other men in the appropriate direction. For small changes a yard one way or the other will throw the burst on or off the target, which is all the correction required. When it is desired to throw the sheaf entirely off the target, firing Numbers 4 and 10, or 1 and 9, is a sufficient indication. To send men thirty or forty yards to one flank to indicate a large error causes delay without corresponding advantage.

Besides the ten bomb men there should be an extra noncommissioned officer whose duty it is to keep the men supplied with powder, see that they are always on the alert for commands and execute them properly and that they use the requisite care in handling powder. The noncommissioned officer in charge has not time to look after these things.

The latter keeps a record of each problem, giving first the name of the officer firing, then the assumed range, then the initial data, followed by every command given by the officer firing, and indicating by a plus or minus sign opposite each range whether it was fired short or over. If a misfire occurs this fact is also noted on the record. Salvos are numbered consecutively in each problem. The principal use of the record is to check up each officer's observations and so obtain his percentage of correct and incorrect observations. Where the observations are not checked up, the record need not be so full, but it is a good idea to keep some sort of record so that corrections may be made consistently, and as evidence in case of disputed shots.

The operator need not concern himself much with any of the initial data except method of fire and range. The other corrections are entirely arbitrary on his part—that is, he assumes the shots would have fallen in a certain place, regardless of where the data given would have made them fall. He should, however, be on the lookout for obvious errors, such as "increase," with the aiming point in rear, or vice versa, and show the resulting distribution in his first shots.

Great care is necessary in handling the powder, otherwise explosions are sure to occur, often resulting in severe burns. It is unsafe for the men to have large cans of powder by them. Accidents will happen even with the spring-covered cans furnished by the Ordnance Department. These cans are awkward to get into quickly and consequently the men will prop open the lid in spite of all cautions. Then a puff of wind carries a spark back to the can and an explosion occurs.

The most satisfactory method I have found is to give each man a small flat tobacco can such as comes with "Prince Albert" or "Velvet" tobacco. This will hold five or six charges. It is easy to pour out of and the top being small there is not much danger of sparks getting into it. If they do, the amount of powder is so small that there are no serious results.

A better can would be one on the order of the old self-measuring powder flask for muzzle loaders, having two sliding discs in the neck,

an inch or two apart. Pressing a lever opens the top disc and at the same time closes the lower one, allowing only the amount of powder between the two to escape and keeping the flask always closed. This receptacle was recommended to the Ordnance Department but was never issued. Its use would insure a uniform charge, prevent waste of powder and eliminate explosions.

The men should be taught to load the bomb with the hammer hanging down towards the ground, putting the powder in first and then inserting the primer, being careful that the lanyard cannot catch on anything in pushing the bomb away after loading. They should never be allowed to lay the loaded bomb on the ground, but should be instructed to hold it in a sloping position across the knees when not in use. If it is laid down, the powder is apt to be spilled and cause a misfire.

An effort has been made without success at the School of Fire to find some substance which would change the color of the smoke to represent a graze burst. Lamp black, yellow ochre, rosin, coal dust and a dozen other substances were tried with the same result. They all give a colored smoke while burning, but when the proportion of powder is increased enough to make an explosion which would resemble a shrapnel burst, the smoke becomes white. If a satisfactory coloring substance could be found, sufficiently inexpensive for this use, it would greatly increase the value of the practice, as the handling of the corrector could be much better illustrated than by merely varying the height of burst by the small amount practicable.

Smoke bomb practice is immensely valuable as training for handling the fire of a battery quickly and accurately, provided it is efficiently and realistically carried out. As it is too often used, it is merely a bore. When one gives a command and then has time to sit down and roll a cigarette before the corresponding shots are fired, he loses all interest.

To conduct it efficiently requires:

1. *A skilled operator.*

This officer or noncommissioned officer must be wide awake, quick thinking, accurate and thoroughly familiar with handling of the sheaf. In addition he must know the mechanism of his own plant thoroughly, so as to be able to place shots where he wants them with the least possible delay and must be able to get snappy action out of his men.

2. *A permanent, or at least semi-permanent, detail.*

This is essential to get speed and accuracy in handling the bombs. Nothing but slowness, mistakes and accidents can be expected with a constantly changing detail.

3. *A good location.*

There should be complete cover for the men. It destroys the whole illusion if men can be seen running around the targets every time a command is given. The range should be 2000 yards or more if possible, in order that sensing may be as much like service practice as possible.

4. *Good telephone communication, and skilled operators.*

If mistakes are made in the transmission of firing data, the shots do not correspond to corrections given and the officer firing is much confused.

5. *Proper targets.*

The canvas targets used at the School and illustrated in the Ordnance pamphlet on the new targets give the effect of service targets on the ground required for smoke bomb work, with the least expenditure of time and labor in handling them. A larger target in most cases makes sensing so absurdly easy that it is worthless.

6. *Apparatus in good condition.*

Rusty, bent firing arms, dirty primer seats and broken staffs cannot be expected to give good results. Torn and flapping targets have the appearance of the week's washing hung out to dry, rather than a battery in action.

AUTOMOBILE ARTILLERY THE CHATILLON-PANHARD TRACTION-MOTOR OF TOTAL ADHESION

BY COMMANDANT L. FERRUS.

Translated by Major Henry Swift, U. S. Army, Retired.

From the Revue d'Artillerie, July, 1913

HISTORICAL

The drawing or towing of vehicles over ordinary roads by a motor or traction engine is by no means a new thing and, from the time that steam-engines have been employed, the effort has been made to use them for this purpose. The first attempt of the kind, of which we have any trustworthy account, goes back to the days of Cugnot.¹ In the Memoirs of Bauchemont (November 20, 1770) we read.²

"There has been talk for some time of a steam-engine for drawing vehicles, and above all artillery, upon which M. de Gribeauval, an officer in this section, has already made some experiments, and the method has since been improved; so that last Tuesday a machine drew at the Arsenal a mass weighing 5000 lbs.³ being the pedestal of a 48 gun of about the same weight, and covering about five-fourths of a league in an hour. It would seem as if this engine might climb the steepest slopes, and overcome all obstacles presented by roughnesses or depressions in the road."

The period between 1825 and 1835, which was one of exceptional activity in the development of the steam carriage in England, witnessed numerous experiments in road traction. Sir Charles Dance⁴ in 1831, and Hancock⁵ in 1836, rendered by its means service to the public of considerable importance.

¹ Nicolas Josef Cugnot, French military engineer, 1725-1804, invented an ingenious steam-carriage, which was put to no practical use, but is preserved in the Conservatory of Paris. He was regarded as a visionary, and lived until his latter years in great destitution; when he was pensioned under the First Consul Napoleon. S.

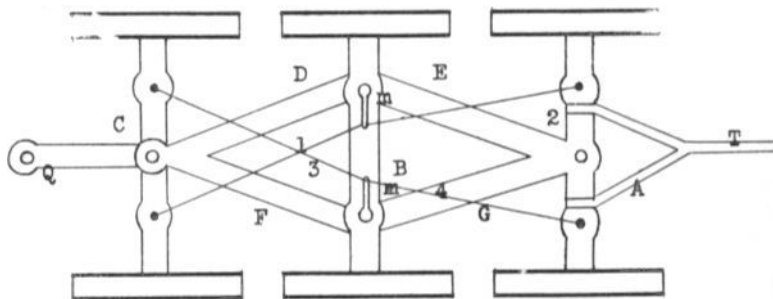
² Francois le Coigneux de Baichemont, author of *Causeries de Lundi*, 2 volumes, to be found in the Library of the Peabody Institute in Baltimore, Maryland. S.

³ Prior to the adoption of the metric system the French pound was equal to 1.0793 pounds avoirdupois. The league was equal to 2.4222 English miles. S.

⁴ In *Automobile Life*, as well as in *History of the Automobile* by Pierre Souvestre (Paris, Dunod, 1907, page 48), will be found a picture of the Gurney steam tractor used by Sir Charles Dance in 1831 to run a line of public transportation from Gloucester to Cheltenham.

⁵ The most brilliant record among the early builders of steam road-carriages

In Belgium, about 1837, steam carriages were constructed by Dietz the elder, which were used in Brussels, plying between that city and Anvers. In France, his son, Charles Dietz, devised about 1833 a continuous train drawn by horses, which he operated several times before a board composed of members of the Institute.⁶



CUT A.—SIX-WHEELED DIETZ CARRIAGE.

A, B, C	Axles
D, E, F, G	Uniting Bands
1, 2, 3, 4	Tie-rods
T	Pole
Q	Coupling-bar
m, m	Hangers

About 1856 M. Lotz of Nantes undertook to make a road-engine to carry passengers and freight. This machine, finished in 1860, served as the model for a considerable number of other engines of the same kind, with which a regular service was established between Nantes and Niort.

The example of Lotz was soon followed by other constructors, as Cail at Paris, Albaret at Lianincourt, and finally by Ernest Michaud, the inventor of the pedal for velocipedes. In fact, about the year 1870, there were a good many road-trains drawn by steam power, especially in the sugar-producing departments of the North, where

is that of Walter Hancock, who between 1828 and 1838 built nine carriages, six actually employed in the transportation of passengers. His first motive power was geared to the front wheels; afterwards changed to the rear wheels by a flat-link chain. Homan, Self-propelled Vehicles, page 7, S.

⁶ The coupled train consisted of carriages, some with four, others with six wheels; and the coupling system was such "that the carriages which follow the tractor (*remorqueur*) are obliged to follow in its track, a most essential condition for turning a curve with a long train governed entirely by the driver of the tractive power." Report by M. Seguier to the French Institute, Royal Academy of Sciences, inserted in the minutes of the meeting of Monday, October 21, 1839.

It will be seen, then, that since 1839 inventors have been engaged in trying to solve the problem of correct turning.

they were used for hauling beets, and where we have frequently seen them in operation.

These services terminated, however, in very short order; for they were expensive and slow, and had, furthermore, the serious disadvantage of wearing out the roads very rapidly. There only remained in 1872 or 1873 a few of the Aveling and Porter, or of the Cail machines, employed mainly by the artillery. We can indeed form some estimate of the pleasure of this kind of travel by observing the lumbering passage of one of the road-rollers belonging to the Department of Bridges and Highways as it passes from one ballast-yard to another, the tractor dragging behind it the van (*roulotte*) which accommodates the family of the operative, and easily covering about three kilometers an hour, like that car in which, a thousand years before our time "the sluggish monarch (*roi faineant*) drawn by four steers, pacing with tranquil steps and slow, traversed the streets of Paris."

There has been no lack of endeavor in trying to devise some practicable method for utilizing steam in road-traffic. Without speaking of the Voydell engine used by the English in the Crimea, which about 1855 employed the wheel-gearings revived some forty years after by Major Bonagente (Italian), and patented by the Krupp Establishment, we might mention the curious contrivance of Amedée Bolée (1873-1880), the steam traction-engine of Dion-Bouton (1897), the steam-tractors of Scott, Le Blant, Turgan, and finally Renard's.

When the gasoline motor replaced the steam-engine, new attempts were made with the Schneider-Canet-du-Bocage automobile battery,⁷ the Aries, and with the Saurer and Schneider tractors.⁸ These attempts gave, and still furnish, interesting features, as is evidenced every year by the experiments of the Military Board on the Handling of Heavy Weights; but the problem did not find a solution that was perfectly satisfactory, at least in the opinion of military experts. After more than a century of effort they were still in doubt as to what method to adopt; and it has remained for the most recent years to arrive at what seems to be a definite conclusion.

⁷ See in the Revue d'Artillerie for August of 1904 (t. 64, page 324) a description of this battery, whose automobile features were studied by the engineer Brillie.

⁸ Tests were made at Versailles by the Board of Engineering Research.

THE PROBLEM OF ROAD-TRACTION.

The problem of road-traction is one that presents points of considerable difficulty. These seemed to be all the greater, as the ingenuity of constructors had been for so long a time absorbed and influenced by the ease of action and the satisfactory results obtained from traction on rails.

And yet the question is not to be considered, as far as the ordinary road is concerned, as on a line with the rail or tramway; at least not from a practical point of view.

In theory, on the other hand, there does not seem to be much difference. The effort or tug necessary to pull a given load on a level has the value of a constant $1/n$ multiplied by T , the total weight of the load. In order that the traction may be effected the force needs to be inferior to the quantity $1/mp$, which represents the adherence⁹ of the tractor of weight P , and adherent weight p .

$$1/nT - 1/mp$$

In increasing to a proper degree the adherent weight, p , and necessarily the entire weight P , it would seem as if it were possible to get all the adherence required. Unfortunately, on a road it is not possible to increase the load indefinitely.¹⁰ The macadamized road, in fact, offers a resistance to a crushing force that is notably inferior to that of steel rails; and when the limit of this resistance has been reached there is nothing more to do. As to multiplying the points of contact with the surface of the road, as is done in the case of rails, it is not to be thought of. The railway should and can be well graded; with the macadamized or paved road this can only be accomplished with the greatest difficulty; and the wear and tear soon demonstrates how hard it is to keep this up. It would therefore be utterly useless to try to employ vehicles with multiple wheels, whose points of contact would not be on the same plane, a circumstance or condition that would call for the most complicated devices.

Still if it be true that the points of contact of a road-vehicle may not be increased beyond a certain extent, it is not less true that the points of contact may be utilized to a higher degree.

It has been customary in the employment of four-wheeled vehicles,

⁹ The adherent weight is that fraction of the entire weight that rests upon the motor wheels. It is therefore, from this point of view, an object to increase as far as possible the adherent weight. This is with most vehicles, including the locomotive, about two-thirds of the entire weight.

¹⁰ In America articulated engines of the Mallet type have been constructed, which weigh as much as 250 tons.

the only ones that are practically available on a road, to utilize as motor-wheels only half of them, generally the rear wheels. It is evident that if the other wheels could be utilized in the same manner, the adherence or grip of the machine would be notably increased, and consequently the power exerted by them.¹¹ Now the maximum weight on the rear axle is fixed by common accord at 5 tons, which limits the adherent weight to 5 tons, and the adherent effort, where rubber tires are employed, to 2.5 tons.¹² In causing the two front wheels to contribute to the adherence the effort will be increased about half as much again, totalling in the neighborhood of 3.75 tons. A tractor so arranged is said to have a total adherence, or in the case of ordinary vehicles is called a four-motor-wheeled machine.

TRACTORS WITH FOUR MOTOR WHEELS.

The superiority of a machine that has four motor-wheels over one that has only two cannot for a moment be contested; but this arrangement is not without its difficulties in construction.

In an automobile constructed in the ordinary fashion, with two motor wheels set on a fixed axle of one piece, and two steering wheels mounted on an axle with mobile axle-arms (steering knuckles), the four wheels in their action follow four different concentric paths. The two hind wheels describe on the ground two arcs, having for their center a determinate point of their axle, while the two front wheels likewise describe curves which have the same point for their center. This last result is obtained by means of a special arrangement by which the two forward pinions converge on the center of action of the hind wheels.¹³

The front wheels not being drivers, their speed or velocity of rotation is determined by their contact with the ground; but this is not the case with the hind wheels. Their velocity, it might be imagined, would also be determined by their paths described on the ground; but, on the other hand, as they are controlled by the motor, it happens that the velocity it imparts to them is determined by the character of the road traversed.

¹¹ See note 9. From this it will be seen that by thus increasing the adherence the motor value is augmented at least half again as much. (Adamson Motor Car Mechanism, page 139, says: "One method of securing a high tractive power would be to drive all four road-wheels from the engine," S.)

¹² The mean coefficient of adherence of rubber tires is about one half (.5).

¹³ This contrivance, quite ancient, was devised in 1814 by a mechanic of Munich, M. Lankensperger. It was introduced into France in 1818 by M. Ackermann, the date of whose French patent is January 27, 1818.

If this condition were not fulfilled one of the wheels might perform slide over the surface, which would greatly increase the difficulty in steering, and cause a premature wear and tear of the rubber tires.

It is well known that the difficulty has been overcome by interposing between the two wheels taken separately and the motor a special contrivance, the differential, which regulates the angular velocity given to each of the wheels by the motor, as the conditions of the road demand. It is a kind of kinetic and dynamic regulator, which distributes the velocity and energy to the wheels.

It is evident at once that in a machine where the front wheels have become motor, it is equally necessary to interpose a differential between these wheels and the motive power.

But this is not all. There is an interrelation between the front and rear axles, as there is between the two wheels of the same motor axle. The combination of the forward wheels has not the same mean angular velocity as that of the two rear wheels, since they do not describe the same path. It is necessary, therefore, to distribute the angular velocity and the energy between the two axles, as these are distributed between the two wheels of the same axle; that is to say, it becomes necessary to interpose a third differential between the two axles and the motor. It is a solution that is at once extremely complicated and expensive, and which has the great disadvantage of multiplying mechanisms that are very delicate. Still it has been put to practical use, and for some years past we have been present at trials on the naval target range at Versailles, where demonstrations were made with the Daimler automobile rapid-fire gun of this type, submitted to the Minister of War by M. Desjoyaux. This machine, it must be confessed, was in many respects remarkable, and the results obtained on slopes of 30:100, on broken ground intersected by portable railway tracks and other obstacles, were sufficient to convince those who were present, who had never given much thought beforehand to the subject, of the advantages to be gained by a system of total adherence.

But inasmuch as the experiments were made with an unattached (*isolee*) machine, and that comparatively light, and not at all with a tractor powerful enough to render efficient service, these essays had no outcome save to leave in the minds of the spectators the memory of having witnessed the action of a very ingenious mechanical toy. They should have had, however, this effect, namely, to prepare them to expect an ultimate realization and utilization of the principle of

total adherence. The officers who were present at these tests, as was the case with ourselves, were impressed with the intricacy of the mechanism employed in the solution of the problem. This opinion was also that of the old-established firm of Panhard and Lavassor, for it has devoted a good deal of time since then in trying to construct a tractor of total adherence; and, despite the interesting results which they knew had been obtained in France, they set about to seek some other and better solution. In this they were in accord with the iron works of Chatillon-Commentry, whose mechanical adviser, Colonel Deport, had been trying for a long time to solve the problem of an automobile system for the artillery.

CONSTRUCTION OF THE CHATILLON-PANHARD TRACTOR.

PLATE I.

The solution adopted for the Chatillon-Panhard tractor was to construct a tractor that "ambled" (or "paced"), if this term may not be considered as smacking too much of the cavalry, as applied to the action of a mechanical contrivance.¹⁴ Instead of coupling the wheels of the same axle, assuring them the possibility of concordant motion by means of a differential, the wheels on a side are coupled so as to give them inevitably the same movement and, under these conditions, there is need for only one differential to coordinate the action of the right couple with that of the left couple of motor wheels; and to adjust the force between them.

It became necessary, accordingly, to make all four wheels steering or guide wheels, the only method for giving the same movement to two wheels in file.

So all the four wheels are at once both motor and guide. They are all constructed and controlled in the same manner, and the wheel control, in particular, gives to the movements an identical direction.¹⁵ There is a perfect symmetry of action in the machine, and from this it becomes remarkably easy to manipulate; for the rear half of the running gear follows exactly the same path as the forward part. Everything works as if the distance between the axles (*empattement*, reach) had been reduced by half: that is to say, as if the chassis were only half the length it really is. The consequence is that the

¹⁴ *Construire un tracteur marchant l'amble*: Amble, a gait in which a horse moves both of his legs on one side at the same time; pacing, racking. Webster. S.

¹⁵ *Braquage*: Not in any vocabulary; from *braquer*, to point a telescope, lay a gun in sighting. S.

Chatillon-Panhard machine is able to describe a half-turn on a radius of 4.5 meters.¹⁶

It is to be observed, however, that what we have said about the identity of movement of the two wheels on a side is not to be taken rigorously, except when the machine is moving on a level. It is, in fact, upon a plane surface that the wheels have the same angular velocity at any one moment; on broken ground presenting rises and depressions the several velocities can in a moment be differentiated; if, for instance, the front wheel is passing over a level, while the hind wheel on the same side is following the profile of a depression, and is therefore going over a greater extent of ground at the time, From this it happens in such a case that there will be a slight sliding movement on the part of the wheel which has the lesser stress upon it. This is one of the circumstances that decided Colonel Renard to adopt for the wheels of the vehicles hauled in his trains compensatory bars, which permitted the main transmission shaft to act upon each wheel along the entire length of the train by means of a spiral spring. These springs lengthen or shorten, one after the other, in passing through any hollow, or in going over a rise; and the uniformity of movement is established in a very brief interval of time, such as marks the moment taken by the passage in succession of the two wheels in file over any fault in the ground.

THE MOTOR.

The motor employed has four cylinders, of 150 millimeters stroke and 125 millimeters bore. It gives 40 horse-power at 1000 revolutions, and 42 horse-power at 1100 revolutions.¹⁷

The cooling is assured by a pump giving a circulation of water through a radiator assisted by a fan.¹⁸

¹⁶ This fact particularly excited the admiration of Commandant Krebs, the able manager of the ancient Panhard establishment, who wondered whether it would not be a good idea to construct an autobus on this plan. Autobuses thus built would, as a matter of fact, possess considerable advantages, especially in going about the network of tortuous and crowded streets, so characteristic of the city of Paris.

¹⁷ We are speaking here of the motor that was employed at the tests made from the 6th to the 20th of March, 1913. The motor used before that time, in 1911 and 1912, was of 6 cylinders of 100×140, which gave 35 horse-power at 1000 revolutions, and 45 horse-power at 1400 revolutions. The cylinders were so combined as to have one water-chamber in common; the whole joined together by screw-bolts of considerable length. A motor group of this kind is very east to manufacture and assemble, and nothing is easier than to replace a cylinder.

¹⁸ *Radiateur a ailettes*: Adams says: "The passage of the air is assisted by means of a small fan driven from the crank-shaft, and placed immediately behind the radiator." S.

The circulation of oil is controlled by a pump driven from the motor. Sparking is obtained from a high-tension magneto.

The throttle and exhaust valves have their cam-shafts separate and placed symmetrically with respect to the motor.

Motor Brake.—The cam-shaft of the exhaust is provided with special cogs which are brought in play when the shaft is displaced longitudinally, transforming the motor into a compressor. In this way is obtained what is called a motor-brake, a system which is by all odds the best, especially on long mountain slopes, giving with little trouble a degree of security that is almost absolute.¹⁹

Carbureter.—The carbureter is automatic, of the system well known as that of Commandant Krebs.

The Clutch.—The clutch is of the multiple metallic-disk type contained in the fly-wheel of the motor.²⁰ It works in oil, and affords a great gripping power, a detail absolutely essential in a powerful tractor.

Transmission Case.—The transmission case²¹ comprises four speeds forward and one reverse. It has three speed-gears (*baladeurs*, balancers) worked by a lever of lateral displacement. A bolt system prevents the meshing of two balancers simultaneously.

The kilometric speeds on the road, answering to a system of 950 revolutions, were respectively of 2.8, 7, 12.6 and 13.9 kilometers. These have been slightly modified according to suggestions made at the meeting of March, 1913.²²

The case is mounted on cross-members, and does not possess direct grip: which prevents the possibility of any serious injury to an engine of this kind.

Differential (Plate I, figure 4).—The driving-shaft A, as it comes

¹⁹ We have seen this brake set up on one of the three automobile rapid-fire guns constructed by the Panhard House in 1911 stop the machine, having a load of 2400 kilograms, on a slope of 30:100, on the upper part of the ridge that looks down on the plain of Villiers-sur-Morin.

²⁰ Page, on *Modern Gasoline Automobiles*, says—page 424: "Power transmission by plates is sometimes accomplished by using a large number of small-diameter disks instead of the smaller number of large plates. The multiple-disk type offers several advantages not found in other forms." S.

²¹ *Boite de Vitesses*, box of speeds, change-speed gear set. S.

²² These speeds are those given by the change-speed gear employed during the meeting of March 6-20, 1913. It has been replaced by one which gives the following speeds at 950 revolutions, 2.5, 5, 11 and 17 kilometers. The second speed thus reduced (from 7 to 5) makes it possible to ascend slopes of 6:100; that is to say, all the rises that one ordinarily meets. The famous Picardy slope on the road to Versailles, so well known to cyclists and automobilists, has only a gradient of 5.6:100.

from the transmission case, is coupled by bevel gears to the single (*unique*) differential B placed at a right angle to the longitudinal axis, and it is designed to distribute the energy between the two files of wheels.

This differential provides for the distribution of lockage indispensable in a tractor, and in the case where the two wheels of a side fail to take hold, prevents them from running wild, to the great prejudice of the usefulness of the other set of wheels.

It acts as ordinarily on two transverse counter-shafts C, operating by bevel gears on the driving-shafts D going to the wheels.

Transmission.—The make-up of the transmission is especially interesting, as it includes neither articulation nor spur-gears to answer the relative displacements of the axles and the chassis, the effects of these being counteracted by special arrangements. The motor-shaft A, coming from the transmission case, acts by means of a conical coupling and the differential B on the two transverse counter-shafts C (Plate I, figure 4). Each of these drives by beveled gears the two longitudinal shafts D, and these shafts D in their turn drive, by the intermediary of a small transverse shaft mounted on the axle H and parallel to it, an auxiliary vertical shaft, whose axis is the pivotal axis of the axle-spindle. These auxiliary shafts carry at their lower end a bevel gear which meshes with a curved or circular rack, which is concentric with and drives the wheels.

The driving-shafts D are encased for their entire length in housings of steel E, which are bolted on one end to the gear-case surrounding the bevel gears affixed to the axle, and on the other end carry a sleeve-bearing F concentric to the transverse counter-shaft C. This sleeve-bearing is supported by the gear-case of the conical pinions of the shafts D, the gear-case being attached to the chassis.

The result of this is that the housings E do the work of compression-rods for the rear axles, and of tension-rods for the front axles.

On the other hand, when a wheel rises or descends the compression-rod E moves about the corresponding counter-shaft C, and this oscillating movement has only the effect of revolving the terminal pinion of the shaft D on the corresponding terminal pinion of the transverse counter-shaft C. Finally the axle attached to the rod E oscillating about C, the length of the shaft D must remain constant, and it is not necessary to constitute it into two parts telescoping the one into the other.

So then, in place of an oscillating movement of the axle assembly,

there is only a movement of descent and rise of a single wheel, and only a slight strain on the housing E, commensurate with the elasticity of the housings.

Steering.—The steering-wheel is geared by a bevel gear to the longitudinal shaft parallel to the longitudinal axis of the truck (*camion*). This shaft passes to the front and rear of the truck through supporting or aligning bearings, where it acts through a worm-gear on a sector on the axis, to which is affixed a steering-lever. This lever acts in the ordinary way, by means of a coupling bar and a connecting-rod, on the two wheels of the front (or rear) axle. The mechanisms being absolutely symmetrical, the wheels take symmetrical angles of direction. The connecting-rods are placed between the two axles; that is, the forward bar is back of the front axle.

Brakes.—Motor brake. In place of the motor brake, of which we have already spoken, and which is the brake ordinarily employed for service of this character, there are two brakes, one for the mechanism, the other for the wheels.

Brake of Mechanism.—The brake of the mechanism, worked by a pedal, acts by expansion on the interior of the two drums keyed to the extremities of the transverse counter-shafts C of the differential. This arrangement has the advantage of obviating the passage of the brake action through the differential, a combination relatively delicate which is in consequence saved from bearing the necessarily rude strain caused by a strong pressure on the pedal.

Wheel Brake.—The wheel brake is controlled by a hand lever. It acts, be it remembered, on all of the four wheels at once, these four wheels being all identical. The control of this brake has as its effect the thrusting of a wedge between the two shoulders affixed to the extremity of the shoes which act upon the drum of each wheel.

This brake, acting at the same moment upon the four wheels of the machine, gives an extremely powerful retarding action.

Wheels.—The wheels of cast steel²³ are provided with double rubber tires, both on the front as well as on the rear wheels.²⁴ The mechanism being symmetrical, there is consequently every advantage in employing four interchangeable wheels. It would seem, moreover, that there is no good reason against distributing the

²³ Wheels of cast steel, which used to be employed but little in France, although generally utilized in Germany for heavy work, are at the present time coming into more general favor in our country.

²⁴ The earlier tractors (in 1911 and 1912) were provided with single tires only on the fore wheels.

weight equally over the two axles, which would certainly serve a very good purpose in going over bad ground, as well as in passing over military bridges, not to speak of the saving to the roads.

Chassis.—The rectangular chassis is formed of two straight stringers of pressed uranium steel 5 millimeters in thickness. Their height is 165 millimeters, their breadth 65 millimeters.

Height of chassis from ground.....	1 meter
Gauge	1.45 meters
Wheel-base	3.32 meters
Total length	4.85 meters
Height of the lower attachments above ground	0.3 meter
Weight of tractor empty.....	5000 kilograms ²⁵
Weight on axle AV ²⁶	2750 kilograms
Weight on axle AR ²⁶	2250 kilograms
Necessary load.....	2430 kilograms
Tractor loaded (including three men)	7430 kilograms
Mean weight of each tow	7570 kilograms
Mean weight on axle AR.....	4450 kilograms

Suspension.—The chassis is hung by four straight springs, mounted on cross-head blocks, and is secured to the axle in such a manner as to permit the play of the running-gear (*faux-chassis*) formed by the connecting rods about the axis of the differential.

Emergency Winch.—Under the fore-part of the chassis is affixed a horizontal winch, operated by a worm which connects when desired with a cog gearing set before the transmission case. This winch carries 50 meters of steel cable of 16 millimeters winding at the rate of 2 kilometers an hour; and is meant to be used to draw the machine itself out of a bad place, or to pull the train towed out of such position by the motor, itself being for the time stationary.

Coupling.—At each extremity of the stringers is attached a coupling-hook²⁷: in addition, at the end of the machine (*arriere*, rear) is an elastic coupler which has a course or play of 25 centimeters.

Ascents surmounted by the Tractor, Speeds.—In the course of the experiments made with the tractor, it climbed the following grades:

²⁵ These weights are of the machine used in 1913.

²⁶ AV, *avant*, front; AR, *arriere*, rear. S.

²⁷ *Crochet de remorque*, hook of towing; while the other term is *crochet d'attelage elastique*, which is not more fully described. S.

Tractor alone, loaded, 1st speed on the gradient of Rue Bauyn de Perreuse at Nogent; road of bad cobbling, wet:	21:100
Tractor loaded (7.5 tons) with two wagons in tow (15 tons), 1st speed, on the incline of Neauphle-le-Chateau; dry paved road, weather fine	4.5:100
On paved road, dry weather, 2d speed.....	4.5:100
Maximum slope climbed with 2d speed, gradient of Noiseul.....	6:100
Maximum slope ascended with 3d speed—about.....	2:100

The speeds attained were as follows:

Tractor alone, loaded, over a course of 107 kilometers	17.13 kilometers
Tractor with train.....	8.44 to 10.58 kilometers

TESTS MADE OF TRACTOR

Official Tests in 1911. The tractor, as it was in 1911,²⁸ was subjected to several official tests during the military meet of 1911, which were made in the presence of several members of the Central Commission of Military Automobiles.

The tractor having a total weight of 7500 kilograms, with a weight of 4000 kilograms on the rear axle, and drawing two automobile trucks weighing together 11,500 kilograms (or a total weight of 18,000 kilograms), ascended at a good rate the slope of Satory with a grade of 6.5:100, the road being macadamized and in good condition. It then ascended an incline, the ground being rather soft, with a grade of 11:100; the coupling-links breaking in course. The tractor alone surmounted a hummock of 60 centimeters at an angle of 30 degrees, and passed over a tree (log) of 40 centimeters diameter placed across the road. Finally the entire train of 18 tons was drawn over a piece of ground on the plain of Satory, the ground being quite soft.

Tests at Vincennes in 1912. In July, 1912, the same tractor was put through various official tests in the neighborhood of Vincennes, before a special commission appointed by the Minister of War. The tractor had a gross weight of 6000 kilograms, of which 2000 was load.

The weight on the rear axle was 3500 kilograms.

The tractor drew a train with a total weight of 19 tons at the rate

²⁸ With a six-cylinder motor (100×140), giving 35 horse-power for 1000 revolutions, and 45 horse-power for 1400 revolutions, and a change-speed gear giving 2.8, 7, 12 and 13.9 kilometers at 1000 revolutions.

of 18 kilometers on a level, and at the rate of 3 kilometers up a slope of 8:100. The machine stalled in a turn of the road, where the grade was 9:100. The train, going at the rate of 5 kilometers, was stopped without difficulty while going down a grade of 9:100, by the brakes both of the machine and of the trucks drawn.

On the Vincennes testing grounds the tractor alone, weighing 7 tons gross, was able to surmount a short acclivity of 37:100, a target butt. Attached to a train of 19 tons weight it drew the same about the field at a speed ranging from 4 to 10 kilometers, and was able to drag out the train, by means of its winch, whenever it mired in bad spots. It was able to drag a large cannon of 155 millimeters, or a mortar of 220 millimeters, over the trunk of a tree 20 centimeters in diameter; also to cross a ditch 3 meters wide and 1 meter in depth.

Maneuvers of Anjou.—At the grand maneuvers of Anjou in 1912 the tractor drew with the greatest ease, as well along the highway as over bad roads, and even through the stubble, three vehicles, constituting an entire 220 millimeter mortar outfit or train (tractor of 7 tons, gun-carriage of 3.7 tons, chassis carriage of 4.25 tons, and platform carriage of 4.2 tons; a total of 19.15 tons).

The train was 25 meters in length when, if drawn by horses, it would have been 75 meters, and would have required 30 horses, nor would it have been able to show the same mobility.

Competitive Meet of Tractors in March, 1913.—The Minister of War, having fully appreciated the advantages that would accrue from the employment of powerful tractors, both for siege artillery as well as for heavy artillery in the field, called for a competitive meet of military tractors from the 6th to the 20th of March, 1913; which duly assembled in the neighborhood of Paris. The essential conditions of the programme were as follows:

Programme of the competition.—The tractor is not to exceed 7500 kilograms in weight, of which 2000 kilograms is to constitute the necessary load.

Without any tow it must accomplish an average speed of 16 kilometers an hour over a course of 100 kilometers.

With a train of 15 tons weight it should attain an average speed of 8 kilometers over an ordinary course not having, however, any rises greater than 8:100.

Loaded but without having any vehicles attached it should be able to ascend a gradient of 18:100. It should be able to pull, by aid of its winch, a train of 15 tons up such a slope.

On a level its tractive power in a continuous pull should attain a value equal to a third of the weight of the load.

The road tests must be over a course of 100 kilometers, six runs of 60 kilometers with load, and two runs of 40 to 60 kilometers respectively to determine speed and expenditure of energy. (*Mesurer la vitesse et la consommation.*)

The programme included, besides, very severe tests on broken ground, the passage of ditches, of deep gullies, of sandy soil, of soft ground, of slopes, and the like.

The Chatillon-Panhard motor has largely satisfied all of these requirements.

Speeds attained.—On a complicated itinerary of 100 kilometers, with numerous rises of from 4 to 8:100, with one slope of 14:100, the tractor alone, weighing 7 tons, attained an average speed of 17.2 kilometers.

On other itineraries, very tortuous, having rises of from 6 to 7:100, there being a great many sharp curves, over a track badly paved, the speed of the tractor, pulling two vehicles that weighed 7500 kilograms each, varied from 8.6 to 9 kilometers an hour.

Adherence Limit.—On one of these courses, at Neauphle-le-Chateau, the tractor and its two trucks ascended at quite a uniform speed of 2.5 kilometers a very roughly paved slope (but dry), having for a few meters a grade of 14:100, and for 50 meters a grade of 13:100. The total weight of the train was 22 tons.

From these experiments may be deduced some interesting conclusions.

The ascent of a rise of 13:100 with a load of 22 tons demands a tractive effort which is represented by the equation—

$$(30+130)\times 22=3520 \text{ kilograms}^{29}$$

Now the tractor had about reached the limit of its adherence, for there were noticed some slight beginnings on the part of the wheels to slip. From this it was concluded that the limit was about 3.520 kilograms for a weight of 7000 kilograms, with .5 as the coefficient of adherence for rubber tires on dry ground, that is, approximately.

Effectiveness.—The speed being 2.5 kilometers an hour, or .7 meter a second, the useful work³⁰ accomplished may be computed to be

²⁹ It may be admitted that the tractive effort was 30 kilograms per ton. It is well known that the stress due to gravity increases one kilogram for every millimeter of increase in rise to the ton.

³⁰ *Le travail developp' aux jantes*; the useful work developed in the rim (felloes, *jauntes*). The term "useful work" is one used by Willcox as applied to machinery. S.

3520×.7, or 2464 kilograms, a figure denoting an effectiveness of 32.8 horse-power.

As the motor was making at that time about 1000 revolutions a rate that corresponds to 40 horse-power, the total mechanical effectiveness of the tractor at the time was about 80 per cent, which is altogether an exceptional figure, above all with a mechanism that was relatively so complicated.

These results show, by the way, that the tractor, as well as the handling of it, was in and under the best conditions (*était resté en très bon état*); that its mechanism was perfect, its assembling very accurate, and its lubrication highly satisfactory.

Elastic Coupling.—Tests of starting made on the slope of Coeur-Volant, above the watering-place of Marly, on a rise of 8:100 for 800 meters, and of 9:100 for 70 meters, were accomplished with remarkable ease (*douceur*) and without any hitch (*sans aucun a-coup*). These were facilitated not only by the smooth working of the clutches, but even more by the flexibility of the couplings which, thanks to a play of some 25 centimeters, allowed the starting of the trucks in succession.

Disposable force of tug or pull.—The force of traction that is exerted by a pull on the level may be computed from the data of the ascent of the slope 13:100, where the total of effort (3520) kilograms reached the limits of adherence, since the machine began to slip (that is, one set of wheels). The force exerted in the traction of the motor on a level is 210 kilograms (30×7); there remains accordingly 3310 that may be expended on the pulling of the train (*sur le crochet*, rather on the hook or coupling), while the conditions of the competition required only 2330 kilograms.

Tests on Ground under Varied Conditions. The tests took place on the Vincennes range, where in places the ground was covered with yielding sand, and where other obstacles were to be encountered. The tractor, drawing three heavy-artillery wagons, each weighing 3500 kilograms, worked without difficulty over the maneuver grounds, up to the moment when the right hind wheel of the last truck became scotched at a hummock of about a meter and a half. It became necessary to detach this vehicle. Besides this, the ground was quite wet and of little stability (yielding, soft), so much so that the motor wheels sank at times to the depth of 20 centimeters. But it was sufficient to attach chains about the tires to give the wheels sufficient grip or adherence to pull out of this bad spot.

The tractor climbed, in addition, some steep slopes, crossed a ditch 3 meters wide and 2 meters deep, passed through a puddle where the wheels were nearly up to their hubs in the mud, climbed over a tree trunk 40 centimeters in diameter, and scaled heights over a sandy surface of from 20 to 30:100.

Finally, it ascended the slope (22:100) of Rue Bauyn-de-Perrouse, which was a comparatively easy thing to do, as it had to use only half the power which it was capable of exerting in order to accomplish the task.

CONCLUSION

From what has been given it will be seen that the problem of a powerful military tractor has been actually solved, and in the most satisfactory manner; and that the new machines are capable of rendering efficient service, not only as answering the needs of the army, especially of the artillery, but besides this in any kind of heavy transportation. The Panhard-Chatillon, in 1912, did valuable work in the way of hauling for the Chauny sugar works.

As far as military transportation is concerned, what we have already said is sufficient to demonstrate how the tractor in question can be used in hauling siege artillery, and above all for the rapid transportation of heavy artillery and ammunition on the field of battle; a transportation so difficult to effect at present with the ordinary means at the disposal of the artillery.

For a long time we left it to foreign nations to grapple with this problem of artillery traction. Thus, in 1904, experiments were made on these lines by Austria with a battery of 15 centimeter pieces, divided into two sections, each comprising:

One tractor carrying implements, 64 rounds, and 12 men;

Two howitzers of 15 centimeters;

An ammunition wagon bearing 36 rounds, 6 men, and miscellaneous equipments.

The mean speed attained by the train was only 5 or 6 kilometers an hour, and its length was about 60 meters.

About the same time Colonel du Bocage of the Portuguese artillery, to whom we had spoken of the very interesting results obtained by the well known-engineer M. Brillie with a reciprocal action automobile of his own construction,³¹ employed as a tractor at the Alcohol

³¹ *Benne automobile basculante*. The above translation is not satisfactory. The dictionaries give no light.

Convention in 1903 (*concours de l'alcool*), ordered the construction at Havre by the Schneider machine-shop, of an automobile battery of four howitzers of 150 millimeters, of which we have already spoken on page 4, which was intended for use as a movable battery in the entrenched camp at Lisbon.

In 1911 renewed experiments were made in Austria with a Daimler tractor, which drew carriages weighing 3500 kilograms, carrying mortars of 24 centimeters (1898 model). Finally, at the present time they are experimenting in the same country with an automobile tractor, drawing a mortar of 30.5 centimeters.

In France, notwithstanding the efforts of a certain number of officers, among whom was General Mengin, the present chief of artillery, there was for a long time a disposition to hold back from the application of motor traction to heavy artillery; but it seems at the present time as if we had waked up, and were trying to make up for lost time, and to take advantage of the remarkable advances that have been made in this direction in our country.

It seems then, as a result of the tests that have been made, that it will be possible to haul a train of 15 tons (21 to 22 tons with the tractor) at a mean speed of 9 kilometers over broken ground, and at the rate of 11 or 12 kilometers over fairly good ground; that is to say, to attain a speed at least twice as great as could be obtained by the use of horses.

Besides this, as we have shown when speaking of the manoeuvres in the West in 1912, the length of the column is materially shortened; a train of 25 meters replacing with advantage one of 75 meters, as well as economizing to the extent of thirty-five horses and fifteen drivers. Now a result of this kind is not to be despised, especially in our days, when there is a disposition to do away as much as is possible with horses and their necessary attendants.

Let us add, contrary to what we ourselves were once disposed to think, and contrary to general opinion, it has been demonstrated that a tractor of total adherence well set up can drag a load out of a bad place, where ordinary methods are found to be absolutely useless. This is seen when, strong as the capacity of a horse may be, there are occasions where a dozen are needed to accomplish the same effort, unless these animals have learned to act admirably in concert, and are exceptionally well handled, neither of which conditions are to be looked for ordinarily in the army. The power of an automobile tractor is, on the other hand, far less circumscribed.

As a tractor can make its 90 kilometers a day more easily than horses can make their 30, which circumstance would be especially valuable in the service of replenishing the ammunition of modern artillery, we can see of what priceless benefit it would be if the powers of this engine could be applied in handling our present-day artillery, and they could take advantage of its enormous effectiveness.

This employment of a tractor of total adherence will most undoubtedly end, at some future period more or less distant, in the creation of a new arm, the automobile artillery.

An idea of this kind would have appeared, only a few years ago, as an idle fancy, and we must confess that we could not listen without a certain degree of scepticism to the prophecies of Colonel Deport, who predicted the application of mechanical traction to our field pieces.

We should have remembered that in 1779 the inventor of the steam automobile, the illustrious Cugnot, had been treated as a visionary by the most eminent men of his time, because he had thought to replace artillery carriages drawn by horses, by fire engines set in motion by the agency of pumps and pistons.

Cugnot had the ill luck to be a century in advance of his contemporaries, and to have aroused in consequence the invincible opposition of that immutable and all-powerful personage, who under another name existed in the days of Louis XVI, M. LeBureau.³²

It would seem as if this opposition had disappeared in the present day, and that a new spirit inspires, from the least to the greatest, our artillerymen of 1913. General Marquis de Saint Auban, if he were alive now, might once more lament "The mania for novelties carried to a point that overpasses belief, and the credulity that resulted, in 1768, in giving orders for the testing of a similar machine," but he would come at last to realize, beyond a doubt, that an engine capable of hauling across the fields the heavy vans loaded with beets in the departments of the North, might be employed without serious difficulty in drawing, on the firing line, the rapid-fire guns of our heavy artillery, and above all to keep them supplied with ammunition.

He would perhaps come then to acknowledge that, notwithstanding the asseveration of the preacher in the Book of Ecclesiastes (Cap. i, v. 9) that it is not impossible to find something new under the sun.

³² Thackeray's Tape and Sealing-wax office. S.

TRACTEUR CHATILLON-PANHARD A QUATRE ROUES

Fig 1-Elevation (50)

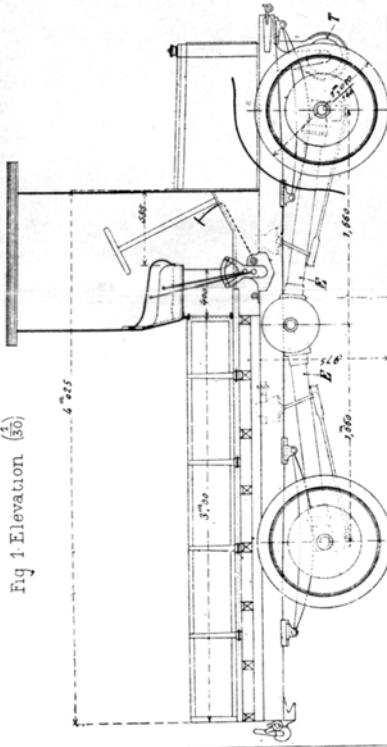
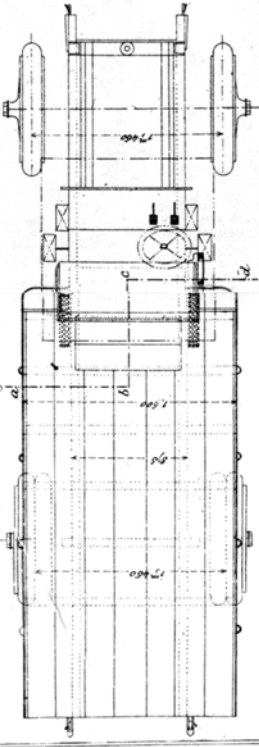
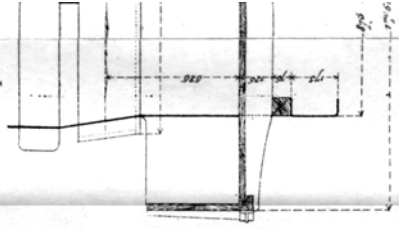


Fig 2 Plan.

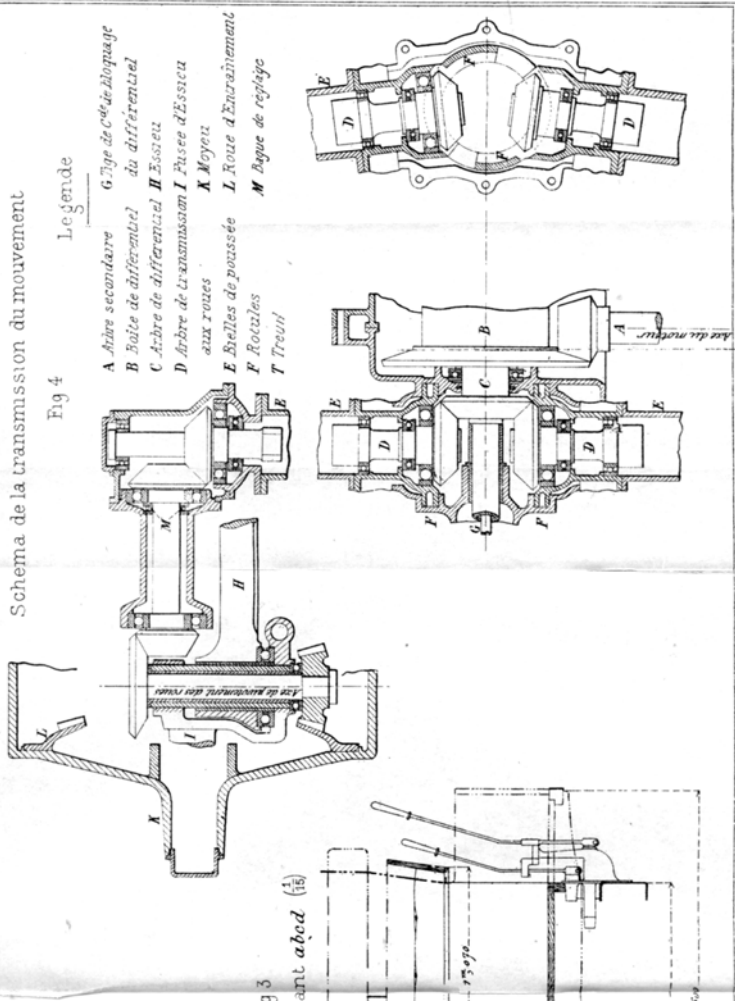


Fig

Coupe sur



TRANSLATION OF
 A. Secondary Shaft. B. Differential case. C. Differential Shaft. D. Transmission Shaft to the Wheels. E. Compression Rod. F. Sleeve Bearings.



LEGEND, PLATE I.
 G. Secondary Shaft of Differential. H. Axle. I. Axle Arm. K. Hub. L. Final Driving Gear in Wheel. M. Ball Thrust Bearing. T. Emergency Winch.

THE MILITIA PAY BILL.

BY MAJ. JOHN MCA. PALMER, 24TH INFANTRY.

Reprinted from the Infantry Journal, November-December, 1914, through the courtesy of the Infantry Association.

The legitimate object of the so called militia pay bill is to make the organized militia of the several states available as a military force which the federal government can use in war to reenforce the regular army for general military purposes.

Under modern conditions, wars are short and decisive, and it may therefore be taken as axiomatic that the time has passed when any nation can safely rely upon levies of raw volunteers to be organized into armies after the outbreak of hostilities. Such improvised forces were used in the American civil war and ultimately attained great efficiency, but this was possible only because our enemy relied upon the same policy, and we were able to begin military operations without an army because our enemy likewise had no army.

The history of the civil war shows conclusively that it takes more than two years, even under the full stress and energy of war conditions, to convert raw levies into efficient armies, and it shows equally conclusively that until this conversion is complete, there can be no decisive military action. But none of our possible enemies of the future will rely upon improvised armies, for the present political and military organization of the world is such that all the great powers can develop their maximum military power in a few weeks. It is obvious, therefore, that a rich and powerful nation that requires a year or two years to get ready, can be no match even for a smaller nation, if that smaller nation can develop its full military strength in a month or six weeks.

We are fond of speaking of our capacity to raise an army of a million men. We undoubtedly have this capacity, but under present conditions, we will not be able to accomplish it until some months after the termination of any serious war that is within the bounds of human possibility.

MILITARY RESOURCES AND MILITARY POWER.

There is a great difference between ultimate military resources and effective military power. A nation's ultimate military resources

are measured by the total number of able-bodied citizens capable of bearing arms, but her effective military power is measured by the number of trained soldiers which she can assemble in time to meet a given military emergency. In short, *Time* is the dominating factor in the equation of power, whether we be speaking of mechanical power or of military power. Our ultimate military *resources* are much greater than Germany's, but in one month Germany can develop ninety times as much effective military *power* as we can develop in the same time. Germany can develop and deploy her maximum military power against the united front of Europe in two weeks, while it would take us more than two years to develop our maximum military power even if we had no enemy to interfere with us or to disturb the operation. Or to borrow another explanatory phrase from the engineering sciences, we may say that Germany's military *efficiency* is near 100 per cent, while ours is probably less than one per cent.

THE TRADITIONAL MILITARY POLICY OF THE UNITED STATES.

But it is not necessary to adopt Germany's military institutions in order to solve our military problem. Our traditional military policy is just as sound for us as the policy of the "Nation in Arms" is sound for her. According to our traditional policy, we should have a small regular army sufficient for peace requirements and strong enough to sustain the first sudden shock of war, with means of expanding this peace nucleus into a great war army of citizen soldiers. The main difference between us and Germany is that while she has converted her traditional policy into a fact, we talk a great deal about our policy but have never converted it into an actual institution. Our regular army is not properly organized as a peace nucleus, and sound methods for accomplishing the great war expansion have never been embodied in our laws.

We have never been able to reduce our war preparations to a business-like system, and in the absence of system, our military institutions have always been hastily molded by political intrigue at the time of national crises. For this reason the chief characteristics of American military history have been extravagance and inefficiency.

WHAT OUR MILITARY SYSTEM SHOULD BE.

The institutions necessary to convert our traditional military policy into a consistent and economical system have recently been outlined in the general staff report on "The Organization of the Land Forces of the United States." The essential features of this system are as follows:

1. The foreign garrisons necessary to hold our national outposts in Panama, Hawaii, the Philippines and Guantanamo, must be composed of trained regulars and must be self-supporting until our Navy can secure command of the sea. They must therefore be always at war strength, for due to their isolation we may not be able to reinforce them at the outbreak of war.

2. We should have a regular mobile army at home organized in tactical divisions, capable of acting instantly as an expeditionary force in support of national policies, and strong enough to meet all military emergencies during the interval required for the mobilization, hardening, and final training of the great war force of citizen soldiers.

3. Our Coast Artillery Corps should be sufficient to care for our necessary coast fortifications in peace and to form the nucleus for the harbor-defense force that may be required in war.

4. We need a regular army reserve composed of former regular soldiers and available to expand the units of the regular army to war strength and to replace losses until raw recruits can be trained.

5. We should have a partially trained army of citizen soldiery, organized in tactical divisions in time of peace and prepared through prearranged and uniform plans to expand the small peace army into a great war army.

6. In the event of an emergency requiring greater forces than can be provided by the regular army and the organized citizen soldiery it will be necessary to organize additional forces of United States volunteers, and order to secure this force in a prompt, orderly, and economical manner, all of the details of its organization should be settled in time of peace and the necessary powers determined by law.

THE RELATION OF THE MILITIA PAY BILL TO OUR GENERAL MILITARY POLICY.

The militia pay bill now pending in Congress is designated to make the organization of the state militia available for federal

purposes and therefore is a step toward providing a force of organized citizen soldiery. It is a concrete attempt toward solving one of the essential requirements of our national military problem and from this standpoint is entitled to most careful consideration.

THE FUNCTIONS OF THE CITIZEN SOLDIERY AND THEIR RELATION TO THE
REGULAR ARMY.

But before considering the details of the pay bill, it will be profitable to examine a certain confusion of ideas with reference to the limitations and functions of citizen soldiery. Some of the advocates of the militia pay bill have argued in the press and before the military committees of congress that the militia should be developed as a national force because it is cheaper to develop it than to increase the regular army, the presumption being that the militia, if so developed, can be effectively employed to perform functions of regular soldiers.

A slight consideration of the functions of the two forces and of their relative degrees of training, discipline, preparedness and availability will reveal the extreme danger and absurdity of this argument. The regular army should of course be no larger than necessary, and regulars should never be maintained to perform functions that can be effectively performed by citizen soldiers, but on the other hand the peculiar functions of the regular army can never be performed by forces having the limited training and availability of our organized militia. For example, we will not be able to use citizen soldiery to garrison our foreign outposts. We will not be able to use them to reinforce those outposts promptly during periods of insurrection or disorder. We will not be able to use them as an expeditionary force ready for immediate employment over seas, and we will not be able to use them to meet sudden crises which may arise at the outbreak of war and before any army of citizen soldiery can be deployed and prepared for general military service.

It is true that the organized militia has developed greatly in the past few years, and the present writer in his experience as a government inspector of the field exercises of the organized militias of New York, Massachusetts, Illinois and Missouri has frequently been surprised at the high degree of progress attained by some organizations within the limited time available for training. But at this stage of our military development no patriotic citizen and no

true friend of the citizen soldier can afford to disguise the fact that the best militia organizations in the force must receive an extended further training before they can be fit for general military employment, and so long as the time available for training remains as brief as it now is, no improvement in organization and no stimulation through the medium of federal pay can make them other than partially trained troops. Such forces are of immense value within the scope of their proper functions of expanding the peace army on the outbreak of war but such forces can never be prepared for instant military employment as regulars can and must be.

THE TIME REQUIRED TO SECURE MILITARY TRAINING AND DISCIPLINE.

It is the experience of the military nations of the world that soldiers cannot acquire the mental, moral and physical training necessary for immediate employment in the modern battle field in less than two years. Every German or Japanese infantry soldier may be considered as being under systematic military instruction and discipline for at least eight hours per working day or for at least five thousand hours during his entire two-year period of service. It is doubtful if the average soldier of the organized militia has received more than one hundred hours of effective training, and under the terms of the pay bill the maximum pay allowed is to go to the soldier who trains for forty-five drills per year or say two hundred and seventy hours in his three-year enlistment. Assuming the training and discipline of the German and Japanese infantry soldier as one hundred percent, it is probable that the average training and discipline of the American organized militiaman is not over five per cent and that within the time available it cannot be raised above twenty per cent even under the most favorable circumstances.

RECENT BRITISH EXPERIENCES WITH CITIZEN SOLDIERY.

These views seem to be confirmed by recent English experience with the territorial army. In the reorganization of the British army after the Boer War, the national land forces at home were divided into two distinct parts, an expeditionary force of six divisions composed of regulars and analogous to our Regular Army, and a territorial army of fourteen divisions composed of citizen soldiers.

The expeditionary force, like any regular army, is prepared for

immediate service and is expected to meet all national requirements until the territorials can be assembled and hardened and their training completed for active service.

The territorials are organized under a definite national system. Their training is directly under the national authorities, and their hours of training are considerably in excess of the hours of training of organized militia. But it is estimated by the British military authorities that the force will not be dependable for general military service until after six months constant field training subsequent to mobilization. It will be available for defensive operations before that time but not for the full activity of the campaign and battle.

TRUE FUNCTIONS OF THE CITIZEN SOLDIERY.

In view of the considerations outlined above we may safely assert the principle that, however important the development of a sound system of citizen soldiery may be, such a force can never be employed to perform the peculiar functions of regular soldiers and that no matter how efficient such a force may become its development can not be regarded as a substitute for necessary increments of the regular army. Citizen soldiers cannot be effectively employed in all the operations of modern war until after a period of final training subsequent to mobilization and until the termination of that period only fully trained soldiers or regulars can be counted upon to meet national military emergencies. How long that period may be must depend upon the amount of training and discipline actually imparted in time of peace. It will also depend upon whether that training is imparted by competent or incompetent instructors and whether or not the force is effectively organized in peace as a well knit national army. But while forces of citizen soldiery cannot be regarded as substitutes for regulars in time of peace or at the outbreak of war, they are of immense value because they form the means of expanding the small peace army into a great war army in an orderly manner and long before this could be done by raw volunteers. This is a function of immense importance but from the national standpoint it is the sole function of the citizen soldiery.

CAN THE ORGANIZED MILITIA BE CONVERTED INTO A NATIONAL CITIZEN SOLDIERY?

Looking at the present state of development of our national military system in a broad way, the two salient facts are these:

1. The country needs a well organized and partially trained force of national citizen soldiery to expand the small peace army into a great war army.

2. Throughout the United States, there actually exists a partially trained force of citizen soldiers known as the organized militia. This force is composed generally of excellent military material, has attained a considerable degree of efficiency, and is capable of extensive development. Its present strength is upwards of one hundred and twenty thousand, and with its organizations filled its strength would be upwards of three hundred thousand men.

The practical question then is, why does not the National government develop this actually existing force into the force of citizen soldiers which the nation needs?

The answer is that the Constitution of the United States expressly denies the federal government the powers necessary to accomplish this desirable and sensible object. The federal government is given the exclusive power to declare and wage war and to raise and support armies but it is not permitted to make an effective army out of the militia and it is not even permitted to employ it as an army for general military purposes. The trouble is not in any intrinsic defect in the militia personnel but in the deficiency of essential powers delegated to the national government. If the national government had the same power over the militia that the British government has over the territorial army, it could easily convert it into an effective army of citizen soldiery like the British Territorial Army. If the national government had the same power over the militia that the Dominion of Canada has over its militia it could make the American militia as effective a national force as is the Canadian militia. If the national government had the same power over the American militia that the Swiss Federation has over the Swiss militia it could make it a homogeneous national force like the Swiss militia. But our Federal government has been expressly denied these powers.

IT IS UNCONSTITUTIONAL TO USE THE MILITIA FOR GENERAL MILITARY PURPOSES.

The Constitution authorizes the federal government to employ the militia to repel invasion, to suppress insurrection, and to execute the laws of the United States. It does not authorize its use for

menal military purposes.¹ Under these limited powers, it could not be used outside of the United States to enforce the Monroe Doctrine, it could not be used to occupy Mexico if such a thing should become necessary, it could not be used to invade Canada in the event of a war on our Northern frontier. It was not used in Mexico during the Mexican war because it would have been unconstitutional to use it for that purpose, and it was not used in Cuba, or Porto Rico, or the Philippines during the Spanish-American war for the same reason. It is true that many militia regiments went to the Spanish-American war but they volunteered under the volunteer law of 1898, and thereby lost their militia status. Volunteers are a part of the armies of the United States and are maintained under the unrestricted constitutional power "to raise and support armies," and can, therefore be used in any part of the world and for any purpose which congress may authorize.

THE FEDERAL GOVERNMENT LACKS THE LEGAL POWER TO TRAIN THE ORGANIZED MILITIA AS A NATIONAL FORCE.

When it is said that the federal government cannot use the militia for general military purposes, enough has been said to show the absurdity of any plan looking to its development as a national war force so long as it retains its status as militia. But this is not all, for even if the Constitution had permitted the federal government to use the militia, it expressly withheld all of the powers that are essential to the peace training of a national military force. In plain terms, the Constitution says to the federal government, "You may use this force if you will not use it for general military purposes, but you cannot train it, you cannot discipline it, you cannot govern it, and you can have no voice in the selection of the officers who are to be its instructors in peace and its commanders in war." All of these powers are expressly denied to the federal government by the Constitution of the United States. Indeed the permission given to the federal government is quite similar to the permission given to the young lady in the nursery rhyme:

"Mother, may I go out to swim?
 Yes, my dearest daughter,
 Hang your clothes on a hickory limb,
 But don't go near the water;"

¹ See opinion of the Attorney General of the United States dated Feb. 17, 1912.

for all of the powers denied the national government are quite as essential to the organization of an effective national army of citizen soldiers as access to water is essential to the act of swimming.

All of these powers are exercised by the government of Great Britain in its development of its territorial army. All of these powers are exercised by the Dominion of Canada in its development of the Canadian militia, all of these powers are exercised by the Union of South Africa in its development of the New South African Soldiery, and all of these powers are exercised by the Soldiery of Australia in the development of the federal Citizen Soldiery of Australia. There is no effective national army in the world, whether composed of regulars or citizens soldiers, in which these powers are not exercised by the national war-making power, and in the nature of things there cannot now or at any time be an effective national force where these essential powers are denied. They are, in fact, the indispensable powers through which military efficiency and unity of military doctrine are secured. Without the exercise of these powers, the personnel of the organized militia can not be knit in peace into a homogeneous war force. At best it can only be a gathering of the clans, a loose league of contingents from forty-eight separate sovereignties. History is full of the weakness of allied forces. Napoleon's entire strategy consisted in taking advantage of the lack of team work in such forces, even when the number of allies was only two or three. If he could have divided Europe into forty-eight fragments he would not have dignified his operations against them with the name of war.

The immense mass of modern military forces and the speed of modern military operations require a cooperation or team work that can be secured only by permeating the entire force with a unified military doctrine in time of peace and this is possible only when the war making power is also the war preparing power. This cannot be secured by the federal government *requesting* each of the forty-eight sovereign to adopt its military doctrine. Each of these forty-eight sovereigns has a prior claim on the employment of the militia, maintains it for its own uses, and has its own doctrine as to its employment and training in peace.

THE POWER TO RAISE AND SUPPORT ARMIES.²

But it is a significant fact that while the Constitution deprived

² The federal power "to raise and support armies" is construed in *Tarble's Case*, 13 Wallace 408.

the federal government of the powers necessary to develop and employ the militia as a national military force, it by no means deprived the government of the necessary powers to wage war and to prepare for it in peace. It gave the new government fatally restricted powers over the militia but it conferred the "power to raise and support armies" absolutely without restriction. The regular army is maintained under this power and the volunteer armies employed in 1846, 1861-65, and 1898 were maintained under this power. Indeed, the peace training of the organized militia in 1898 was made available to the National Government through this constitutional power because the volunteer law of that year permitted organized militia units to volunteer as a body into the volunteer army, and by this act they were legislated out of the restricted militia status, and into the unrestricted federal soldier status. After this change of status they were an integral part of the armies of the United States and could be employed in Cuba, or Porto Rico or the Philippines or any other place within the sphere of national interest, for there is no restriction on the powers to raise and support armies. Under that power, congress can support a professional regular army such as we now have, and it can also if it chooses support a non-professional citizen soldiery army like the territorial army of Great Britain. In short, it can raise any kind of an army that national requirements may demand.

HOW THE MILITIA PAY BILL PROPOSES TO MAKE THE MILITIA AVAILABLE FOR
FEDERAL PURPOSES.

Now the militia pay bill proposes to utilize the organized state militia for federal purposes by destroying its militia status under certain conditions upon the outbreak of war and transferring it to a new status under the power to "raise and support armies." Though two essential features of this measure are as follows:

1. It proposes to give pay from the federal treasury to such officers and enlisted men of the State militia as may qualify as to fitness for military service under such regulations as the Secretary of War, *after conference with the national militia board*, shall prescribe.
2. It provides that the President with the consent of congress, in time of war or when war is imminent, or in other grave emergencies, requiring the use of troops in excess of the regular army

beyond the limits of the United States, may by order transfer to the army of the United States any portion of the organized militia receiving or entitled to receive the benefits of this act, to serve therein for two years.

Under the first feature of the bill as outlined above, it is supposed that the federal government in consideration of the appropriations for pay will acquire an indirect but effective influence and control over the training, discipline and organization of the militia. The states will still retain their constitutional power of appointing the officers of the militia, but federal pay will go only to those officers who are qualified for these offices according to federal military standards. The states will continue to govern and train the militia in time of peace, but this training must conform somewhat to federal requirements in order to attain the standard of military fitness which will entitle them to pay.

Under the second feature of the measure, the constitutional restrictions upon the use of the militia are removed in so far as the paid militia are concerned, because all such militia men will upon the order of the President and the consent of congress be *ordered* into the army of the United States to serve in conformity with their enlistment contract for two years unless sooner discharged. They are thus removed from the militia status and become part of the national force which can be employed wherever national interests may require them.

If congress is satisfied with the constitutionality and effectiveness of the "enlistment" feature of this bill, which in effect creates a federal status, there can be no doubt that it will in effect restore to the federal government some of the powers denied it by Constitution and for the lack of which it has been powerless to develop the militia as an effective national force.

THE EFFECT OF THE PAY BILL IF IT SHOULD BECOME A LAW.

If it should become a law, a company of militia whose members were receiving pay thereunder could be ordered into the army of the United States and sent to Nova Zembla or Patagonia if a national emergency justified it. It could be kept there for at least two years and all of its members would be required to serve such time under penalty of court martial.

Or if all of the organized militia of one of the States should qualify for pay under the terms of the bill, it would be competent

for the President on the eve of war to order all of its organized militia out of the state and on foreign service, and upon receipt of such an order all of its organized militia would cease to be militia and would no longer be under the control of the state authorities in any manner whatsoever.

In other words, it appears probable that the bill will accomplish the object of making the militia available for general military employment under the federal government in time of war, and, if this cannot be done, there can be no justification for pay from the federal treasury.

WHAT WILL THE FEDERAL PAY BILL COST?

The appropriations necessary to pay the militia under the pay will be considerable. With the present strength of the organized militia it is estimated that about ten million dollars per annum for pay alone will be required. But as it should be the policy of the government to develop in peace all the citizen soldiery the country will require on the outbreak of a great war and as this force is estimated in the "Report on the Organization of the Land Forces," to be about three hundred and seventy-nine thousand men, the ultimate pay bill if the system is successful will soon be upwards of twenty-four million dollars per annum.

BUT IS FEDERAL PAY NECESSARY IN ORDER TO SECURE A CITIZEN SOLDIER?

But is federal pay for the state militia necessary in order to secure a sufficient and effective citizen soldiery? An examination of the military forces of other English speaking nations will throw an interesting light on this question.

The United States with a population of about ninety-two million has a force of about one hundred and twenty-two thousand organized militia, or one thousand three hundred and twenty-four citizen soldiers to each million of population.

The United Kingdom with a population of about forty-one million has in its well organized territorial army three hundred and seventeen thousand citizen soldiers none of whom are paid. This means seven thousand seven hundred and seventy citizen soldiers to each million of population. If the young men of the United States would enlist in the same relative numbers as the young men of Great

Britain we could have a citizen soldiery of seven hundred and fourteen thousand six hundred and twenty-two men or nearly twice as many as we need.

The Dominion of Canada with a population of a little more than seven millions has a national citizen soldiery of about sixty-four thousand men, none of whom are paid. If our young men should enlist in the same relative numbers we would have a force of about eight hundred and twenty-six thousands men or more than twice as many as we need.

The Federation of Australia with a population of about four million four hundred and fifty-five thousand has a partially trained citizen soldiery of about eighty-eight thousand,³ none of whome are paid. If our young men should enlist in the same relative numbers, we would have one million eight hundred and two thousand six hundred and fifty-one citizen soldiers or about five times as many as we need.

Why is it that where one young American enters the organized militia, more than five young Englishmen enter the territorial army, more than six young Canadians enter the Dominion militia, and more than fifteen young Australians enter their national citizen soldiery? It cannot be solely because our men are not paid, because neither the Englishman, the Canadian nor the Australian is paid for the time he gives for military training. Can it be because the young American is less patriotic than his fellows of the English speaking race, that we must pay him to perform a duty that they perform as a free and voluntary patriotic service?

If the answer to this question should reveal some fundamental defect in our military institutions, then the correct solution of our problem of citizen soldiery lies in correcting that defect and not in paying man to serve in spite of the defect. In this way we may secure not only a better institution by may avoid the enormous expenditures that the pending pay bill will involve.

THE REAL REASON WHY SERVICE IN OUR ORGANIZED MILITIA IS NOT
POPULAR.

Now there are many reasons why service is more attractive in the forces of Great Britain, Canada, and Australia than in our

³ This was the number before compulsory service became effective. Under compulsory military service it is expected that the force will attain a strength of 250,000.

organized militia, but the chief reason and one sufficient to account for the whole difficulty is this. If a young man enlists in the territorial army of Great Britain, he enlists in a definitely organized force which can be used for war purposes only. In other words he enlists to be a soldier in war.

But if a young man enlists in the organized militia of Illinois he does not enlist in a national force and he does not enlist for war service only. He must enlist in a force which is frequently employed in the aid of the police power of his state. In other words he must be a part of the state constabulary as well as a soldier, and he must be ready for strike and riot duty which are not connected in any way with preparation for war or national defense.

Of course this aspect of the question directly repels thousands of young men just the kind who would make the best soldiers. Nor does the repulsion extend only to men with direct union affiliations, for many young men who have no such affiliations, would prefer not to enter an organization which must be employed against their fellow citizens in times of public disorder. This is not because they are in sympathy with public disorder but because they prefer not to be policemen. There are thousands of young men in the United States who are unwilling to serve in the militia for this reason but who would gladly serve in a national force to be employed in war only.

In other words if we use the organized militia as our citizen soldiery we are creating a force with a double function, a state police function and a federal war function. Obviously in the limited time available for training, this force cannot perfect itself in both functions, and obviously this force can never attract all of the young men who want to volunteer to prepare for national defense. This is true because in the nature of its organization it can only use those who are willing to perform the double function and therefore all of the soldierly young men who want to volunteer for war service only are permanently excluded from the force. This is due to an inherent *defect* of the system, and no provision of federal pay can correct it.

THE BETTER SOLUTION PROPOSED BY GENERAL UPTON.

Now let us consider the more scientific solution of the problem proposed by General Upton in his "Military Policy of the United

States." He proposed to form a federal citizen soldiery with a battalion of infantry in each congressional district, organized for war purposes only and maintained not under the militia clauses of the Constitution but under the unrestricted federal power "to raise and support armies." Such a force would be like the territorial army of Great Britain. He also proposed to leave the militia as the Constitution evidently intended it, as essentially a state force and not to be considered in national war plans at all except for the limited and local uses authorized by the Constitution.

This would abandon the organized militia as a national military institution but would not necessarily abandon its present military personnel, for on the formation of the new force those of the organized militia who want to be real soldiers could pass into the national force and those of the organized militia who want to be militia or militia-constabulary could remain in the militia.

In the original appointment of officers in the new federal force, a preference would of course be given to officers of the organized militia who elect to transfer from the state force to the new federal organization.

With the militia thus restricted to purely local duties within the several states, the composition and organization of the force within each state could be adjusted to actual requirements and would be purely a state question in which the federal government would have no interest. Under the militia pay bill, the states are to be encouraged to maintain greater organized militia forces than they actually require with the prospect of having the whole force *ordered* into the federal army and ordered out of the country at a time when it might be urgently needed for local defense or for the maintenance of public order.

Indeed, it was probably to prevent this very contingency that the founders of the government deliberately and advisedly restricted the federal powers over the militia. They evidently intended to preserve the militia to the states for local uses and to prevent its employment as a national military force.

On the other hand, the military grants proper, that is, the power "to raise and support armies" and the power "to provide for the government and regulation of the land and naval forces," were conferred upon the new federal government without any restriction whatever.

The national volunteers recommended by General Upton could be scientifically organized by Congress as a war force without consulting forty-eight separate sovereignties that, under the Constitution, have nothing to do with the conduct of war. The battalion in each congressional district would be a real school of military training to attract all of the patriotic young men in the district. The appointment of its officers would be determined by federal laws and could be based on efficiency and capacity to instruct.

Service in this battalion would practically never involve strike duty or other service in aid of the civil authority, because the battalion being a federal force could not be so employed except on the call of the state authorities upon the federal government, and upon such a call the federal government would naturally employ its paid regulars before calling upon the citizen soldiery. Furthermore if Congress should restrict it to war service only it could not be used for any other purpose.

Having a battalion in each congressional district, each group of three would form a regimental district, each group of three regimental districts would form a brigade district and each group of three brigade districts would form a division district. In each division district the cavalry, field artillery, engineers, sanitary units and other necessary auxiliaries of the division could be directly organized by Congress without any conflict with or restriction by state authority. In other words, the force could be organized and trained under a uniform national doctrine and could be modified from time to time as national interests change. This will, of course, always be impossible in a force over which the powers of the government are limited to advising forty-eight separate states to form their local forces in a manner that is generally contrary to their own prior interests.

Such a force would also protect the individual interests of the citizen soldiery in a most important particular. The American volunteer who is willing to risk his life in the national defense is entitled to trained leadership in war, and no one should be entrusted with the command of American soldiers who is not trained for that responsibility in time of peace. In a national force Congress could restrict initial appointments to qualified candidates and could provide for an equitable system of promotion based upon experience

and ascertained merit. This would open the highest military rank to ambitious and competent members of the force, but would eliminate the demands of politics, intrigue, and state expediency.

In many of the colleges and universities throughout the country, thousands of young men are receiving a military training that should qualify them for service in any popular military force that is based on the idea of utilizing our potential military resources. Very few of these young men are utilized in the organized militia. They are well prepared for such service, but are generally unwilling to enter a competition for recognition in a force which is primarily a state constabulary and only secondarily a national soldiery.

Again under the peculiar conditions of militia service the facilities for training are now restricted almost entirely to the young men of the cities and towns. In a national force thousands of young country men could be utilized just as they are utilized in the English territorial army or the Swith national militia. Our national military force would thus become a nation-wide educational institution and would give a training in discipline and soldiery self-reliance without the additional and unnecessary burdens and annoyances that must always discourage thousands of enlistments in a semi-constabulary force like the present organized militia.

It therefore appears that while the militia pay bill is one means of securing a national citizen soldiery, and is to that extent a commendable measure, an examination of the facts will reveal that it is the most expensive and least effective means of accomplishing the object in view. If adopted, it will always be an expensive, incomplete, and unsatisfactory solution of the problem. The organization of a national citizen soldiery under the constitutional power "to raise and support armies" will be better for the nation, better for the states and better for the soldierly personnel in the organized militia who are now striving to be national soldiers in spite of burdens that must always impede their progress.

AVIATION AS AN AID TO ARTILLERY.

From the Revue D'Artillerie for March, 1912.

Translated by 2nd Lieut. James A. Merritt, 14th Infantry.

*Summary of a lecture by Captain Charet before the Military Club of Paris, at the Reunion of Officers of the Artillery Reserves.*¹

Man knows how to fly. The different branches of human activity are about to undergo vast and extensive changes. The Art of War is especially affected. What is the reason?

I will not treat this great problem in its entirety, because this talk would not be sufficient to cover such a big problem. We take today one particular phase which interests us the most as artillerymen and the importance of which is primordial, the utilization of the aeroplane by the Field Artillery of the Army Corps.

All the tactics of our branch of the service can be summed up very simply, "To assist the infantry by making their target ours, and to draw the fire of the enemy's artillery." Our science, outside of the particular knowledge which the matériel requires, will take only a few words. It consists of making use of the quick, exact and powerful devices that we possess for firing accurately. Just a few years ago we placed our guns on the highest ground, and we found that by doing this we solved our two problems—technical and tactical. Yet, to tell the truth, our contact with the infantry, obtained solely by eyesight, was to a certain extent precarious. The "instinct" of the artillerymen intervened more or less effectually to remedy this.

That was the age of fine positions, and our branch, in its splendid isolation, well deserved then its naming of "Special." But the times have changed with the necessities of modern war. At present the Germans dig holes to get themselves under cover; and our battery commanders can not always find a convenient and suitable observation post, even at a great distance from their organizations. In this case getting the range by volleys becomes very difficult. Moreover, everyone knows that many of instruction shots at the School of Musketry, when fired under real war conditions, miss completely on accuracy of range. We place entirely too much confidence in "perfect screens" making a map showing the tactical problem in the

¹ For further information on this same subject see an article "*Aerostation et Aviation*," Revue d'Artillerie, Feb., 1912.

maneuver to be made. Occasionally, without paying any attention to the technique of the arm, the objectives are not substantially represented. A current expression which we have decided to accept as a definition of modern fire is, "We sprinkle the soil." But this watering is very frequently synonymous of waste; and our valuable munitions are swallowed up in efficacy of fire whose result, alas, seldom corresponds to the name at all.

The Russian-Japanese War offers us very remarkable examples of the different questions we have just discussed, because they form, to a certain extent, the skeleton of our discussion of today. Having started according to the latest method of the Germans, by firing exposed, the enemy's artillery quickly decided after a few shots, to adopt the French method of completely protecting all their artillery.

But, under these conditions, one could always see and especially during several days at Ingoua² (Sept. 30-Oct. 3, 1904), many guns of Japanese type, whose fire was conscientiously directed at suspected ground on which there was no enemy.

A field observatory (a ladder suitably erected and supported) has been many times proposed in order to guard against errors. For the past twenty years a number of inventors have presented ingenious solutions. It would seem that we have finally adopted one.

I do not hesitate to omit the interesting efforts which have been made to produce aerial observatories by the use of kites, and I wish to take this opportunity to pay a solemn tribute to the memory of Captain Madiot of the military Aviation School of Vincennes, who was killed in an aeroplane. This efficient officer knew how to establish a kite-train which was conceived in an absolutely remarkable manner. I will recall to mind the excellent advice that our regulations give to battery commanders for increasing their field of view: stand on the roof of a mill, climb to the top of a tall tree, crawl up a churchsteeple, etc. But these ways depend upon luck and they frequently fall to the officers who have never graduated from the School of Gymnastics at Joinville. The best of all these methods constitutes, moreover, only a passable remedy for the difficulty of observation endured by the Field Artillery, and for which the real remedy has fortunately been found, as we shall see further on.

I have just outlined rapidly our technical difficulties. It would seem that in the tactical arrangement the complications arising from

² See *Revue d'Artillerie*, Nov., 1910.

defilading have grown in the same proportions. If it had remained this way, our arm would have found itself in a very bad situation. But the difficulties themselves brought about solutions which we would have been able, after all, to adopt advantageously at the time of contact "by the eyes." The wise mind had perceived, as a consequence, that in order to know the needs of our infantry when they became invisible, it was sufficient to get into closer contact with them. A study of communications made since then developed numerous arrangements that we still make use of frequently, but there is no reason for reconsidering them in this talk.

From this rapid review of the requirements and duties of our arm it becomes obvious that for all artillery thoughtful of its efficiency, there is this unquestionable necessity, "To see, above all things."

Certain artillerymen have such an impression of this idea that they are not at all able to accept the necessities to which modern war has reduced us. Neither do they approve of advancing under cover, nor the occupation of hidden positions; and they recommend, in spite of all, in the majority of cases barbette firing and going into battery at a rapid gait, which is so suited to our French temperament. Our actual method of communicating, of the occupation of positions, and of the choice of observation posts, seems to them too complicated and inappropriate in war. The opinions of these gentlemen, who are against anything progressive have to be respected, because they recommend a simple advance without which we could not be sure of the manner in which to gain victory.

But their objections, without discussion, do not amount to much since the aeroplane has come into existence. Thanks to the aerial eyes, the artilleryman is now able to see the dispositions of the enemy no matter what they may be like. To form some idea of what these machines are able to do, just imagine what an observation station similar to the Eiffel Tower would be worth if it could move around and prevent the enemy from knowing the range to our batteries. From the height of such an observatory we could see all the movements and dispositions of the enemy and could help our gunners lay their pieces on the intended objectives, as if in miniature, like the children with their toy soldier games. Those of you who have taken part in target practice from the heights along our coast can verify my statements. Also, those field artillerymen who have watched hits being made from high posts like Puy-de-Dome and the

target range at Fontaine-du-Berger can well understand the perfect conditions we obtain from altitude.

The aeroplanes we produce today are indications of wonderful progress, and we have the right to be proud of them. But it should not make us forget the glorious page the past fifteen years has written in the history of the artillery. The beginning of this period is marked by the coming into use of the 75 millimeter gun, a metallurgical and mechanical masterpiece, which even in our day is of unquestioned workmanship and the best gun in the world. Since then, what efforts have been put forth to make this admirable material, in spite of the difficulties of cover, truly effective! What struggles we had against old methods to make it something more than a machine of fireworks and loud noise like the trumpets of Chinese pirates!

All honor to the apostles of this heroic age to have been steadfast in the face of great prejudices!

The applications of the principles which they have engraved on this glorious page will frequently be of great use to us, but progress, always on the march, commands us to pass on.

We now see appear majestically in the azure of the heavens a splendid apotheosis, the aeroplane, a veritable thinking projectile, a privileged younger brother of the shells. Within a few years, in my opinion, it will be able without a doubt to perform a direct offensive rôle, and in that case—but only in that case—to constitute a new arm of the service. By the side of its older brothers on land and sea which it will ultimately unite, the aerial arm will be called to change from top to bottom all our antiquated military organization. When this hour, which is necessary before we will put more spirit in our work, arrives, war will be carried on according to the declarations of the forerunner Ader. In passing, we salute this great Frenchman, and look forward with great confidence to the realization of the principles that he, in 1898, described so minutely in his fine treatise on Military Aviation. But until that time the military aeroplane or "avion," according to the suitable name which Division General Roques, our permanent inspector of military aeronautics, has given to it, does not wish to remain inactive as an instrument of war.

In particular, it wishes from now on to inspire the artillery with new life and to permit our arm to fulfill with greater facility and convenience its all important rôle, by substituting its keen bird's-eye

for the unhandy telescope and field-glass upon which the artillery is now dependent. Do not believe that the picture of which I have just sketched the outline is a vain imagination, the idea of a dreamer or a bold Jules Verne notion. The realization has already been accomplished, and a veritable torrent of enthusiasm has excited to action the officers of all arms who were present at the first artillery firing with the aid of avions.³ These experiments, to which we will refer later, were made without any preliminary study or agreement between those doing the firing and our aviator officers. With a mastery truly French they were at all times in touch with the batteries in a convenient, rapid and effective manner. Before going farther I wish to bring to your attention the fact that our Permanent Inspector has entirely approved of the methods adopted at the School at Vincennes concerning aviation in the artillery. This sanction of their work by the eminent General-officer in charge of aeronautics should be sufficient to establish their worth.

Without more delay we shall see how, under the initiative of its Director, the Aviation School at Vincennes has studied and solved these deeply interesting artillery problems which I have the pleasure of developing today before you.

THE USE AND ORGANIZATION OF AVIONS.

We are going to see in succession—how a battery commander and an aviator are able to communicate with each other in regard to laying guns, how an avion can be packed for transportation so that it can accompany everywhere the batteries to which it is attached, the manner of assembling an avion so that the maximum work can be obtained from it, and finally, the best way to organize them when they are to be used with the artillery.

In order to carry out the plan of Colonel Estienne, whose aim in life has been to make the aeroplane afford assistance to the artillery, numerous experiments were held, without the assistance of our arm, at the Aviation School at Vincennes as well as at its annexed field at Chalons. This period of trials ought to convince completely the officers of the school that the aeroplane will enable us to solve the two following problems which are of all importance to our arm;—⁴

1. To control the firing.
2. To indicate to our batteries objectives that are invisible to them.

³ See note number 9.

⁴ See in *Militar Wochenblatt*, Sept. 14, 1911, the article entitled "*Ueber die Verwendung der Luftfahrzeuge in Frankreich.*"

The necessity of solving the first of these will be constantly felt when it is a question of determining the limits between over and short shots, which we can do by using certain signals. For example, we will be able to fire effectively against an objective which is masked by a crest from which our scouts have been chased away. Until now the mission of procuring similar information fell to the lot of officers or noncommissioned officers who were sent ahead to reconnoiter and report the number, position and so forth of the enemy's batteries so we could regulate our fire. These men were taken from their organizations. Except in particularly extreme cases it is evident that the work of these scouts would be almost impracticable. And furthermore, in using them, we deprive their batteries of their most intelligent and best all-around men at a time when they need them most. This is not a very wise thing to do. How much more simple it is to use signals between the batteries and an aviator!

The study of special signaling began under the conditions I have just mentioned was taken up again in 1911, at the camps at Mally and Chalons,⁵ this time in cooperation with the artillery, particularly with the 60th regiment, which had lately been through a practical course in field firing, and with the 17th regiment. The verification of expected results was absolute. Our experiments in real firing have been made, you understand, without the assistance of infantry. This fact should prevent us from feeling uneasy on the question of an aeroplane being able to communicate with our own arm, which is, as I have told you, one of the essential duties of the artillery. Moreover, it should convince us when we consider that an aeroplane sees everything. We can rest assured then that our aviator officers will be able to show the batteries by the methods I have mentioned the objectives which the infantry wants them to silence.

The prowess which our aviators exhibited at the recent great maneuvers proves that they are capable of even more difficult tasks. Be that as it may, our avions will be exceedingly useful if they can from now on work in connection not only with the artillery, but also with the infantry which the artillery is called upon to support. I repeat that the cooperation between these two arms by the aerial medium will not be complicated, but things that are simple cannot be done easily in time of war, unless practiced in time of peace.

To return to the two problems referred to we will see from the

⁵ See, on this subject, the information given in the report of the Army Estimates (drills of 1912) by M. Clementel (*Revue d'Artillerie*, Feb., 1912).

very start how an aviator-officer and a battery commander are able to communicate.⁶ Communication from the battery commander to the aviator is easily established by using conventional signals. With regard to communicating from the aviator to the battery commander, it is done by sending a report which the pilot detaches from a memorandum pad placed near him, to which he attaches a small heavy object such as a nut or a lead bullet, by passing a metal wire loop through an eyelet. The aviator indicates by a cross mark on his report the actual position of the objective with reference to the point where he let the message fall. This operation does not require any measuring of angles, direction and so forth. Everything is estimated by the eye. It is a sketch showing only a few points. It is sufficient afterwards to drop down a report showing the range from the battery.⁷

We now see how the operation, which at first appeared very complicated, is simple and easy for the aviator to execute. Do not imagine that he is a machinist who is always occupied in handling controlling levers and wheels to keep his apparatus balanced. It does not require any more nerve and endurance to manage an aeroplane in normal times than to manage an automobile, and an aviator should be able to fly for hours without hardly ever touching the balancing mechanism. This statement is very interesting because a monoplane will be all we will ever need in artillery aviation.⁸ A young pilot who is not afraid of the powerful vibrations can take his apparatus in one hand while with the other he can write the information intended for the batteries. Just like a good cavalryman whose arm is passed through the reins of a spirited horse which he has to hold in check by pulling constantly on a hard mouth is able to reconnoiter without worrying and to note the results of his observations. Thanks to the monoplane, he can put our whole attention on the sketch. A pilot can also execute without delay all necessary evolutions for accomplishing his mission.

We have just seen how we establish communication between the aeroplane and a battery. Reading the weighted message, the captain will have proof that his pieces are properly laid, or he will know how

⁶ See in *l'Illustration*, Sept. 9, 1911, an article entitled "*l'Aeroplane et le tir de l'artillerie*," and in the *Technique moderne*, Dec., 1911, the article entitled "*Utilisation de l'aeroplane pour le réglage des tirs d'artillerie*."

⁷ See note number 9.

⁸ See, on this subject, in the *Matin* of Dec. 3, 1911, an article entitled "*Nos oiseaux de bataille*."

to change them. If he sees that the errors in range are very considerable, he will order the aviator to verify his information by repeating the process. Experience has shown many times that it is easy to obtain quick and perfect results in this manner. Whenever possible, the pilots will not be stingy with their information, but will show the position of the infantry reserves and artillery limbers. But this is supplementary information and does not help us to get the range of the objective in question.

Instead of using message blanks, the aviator may be able to fly over objectives and make a visible signal at the exact instant he is directly above them. This is one case where our regulation signals will come in handy. In this method of sending information, which we have already tried, it is not absolutely necessary that the pilots be artillerymen. Generally, though, the observing officer should belong to the arm for which he is reconnoitering, especially when operating for artillery. When shown the method of signaling, the aviator constitutes for the time being the brains of the battery of which the captain, from a scientific firing point of view, is only an organ of execution. At any rate, it is this way now whenever the captain remains with his guns and leaves the observation to one of his subalterns.

Until the time when military aviation shall play the part we shall tell about farther on, we should recruit aviators from the arm with which they will be used, and it will be a good thing if we make these aviation scholars take a course in the musketry schools of the different arms. By doing this the officers will get some excellent practical instruction. Besides, this method will surely result in perfecting methods of actual aerial signaling.

Whatever the case may be, this question has gone far enough for us.

1st. To establish immediately aviation in the artillery.⁹

2nd. To change our firing regulations so that they consider the assistance of avions.

⁹ The question of aviation of the artillery has been discussed from the rostrum of the Senate by the Aviator-Senator M. Reymond, Feb. 13, 1912, who declared himself in these words:—"In March, 1911, at the camp at Chalons, there were some experiments bearing on the subject of the employment of aeroplanes in artillery firing. All those who took part in them have returned very enthusiastic. We should not let the opportunity pass without responding to the declarations that they have made.

"It is not necessary to recall to you the methods of our artillery during a battle. They use indirect fire mostly, and are always masked. This presents the embarrassing situation of two batteries that are willing and ready to fire at each other,

Aviation apparatus we are bound to make a part of artillery units for the same reason that we did field-observatories, battery-telescopes, field-glasses, range-finders and so forth. We make a great mistake in believing that the artillery would be able to get any benefit from avions belonging to other arms, particularly to the General Staff, as many have proposed.

In war we do not fight every day but we do make a reconnaissance. Besides, whenever there is a battle, it happens all of a sudden. We may rest assured that the batteries will not have at their command any avion at the exact moment they will be needed, if they have to await the arrival of a General Staff apparatus that may be in use. It is therefore strictly necessary that the artillery avions be at their proper post so that they can follow the battery to every change of station. We can do this very easily by using a small vehicle capable of holding any of the small type of monoplanes. These conveyances will be something like a gun and carriage used as a wagon, which we can hook up to a field-gun limber, a self-propelling limber, or better still to an automobile. In fact, mechanical locomotion will be always necessary if we want to be sure of furnishing and replenishing ammunition, stores, and so forth, which are all operations which must be done rapidly.

We know, however, that this outfit has passed the test of the big maneuvers of the 7th Army Corps.¹⁰ But some may claim that these

but who are masked by the crest of a hill and are not able to know exactly where their opponent is. Artillerymen years ago said, 'If someone would only give us a ladder 300 yards long, we could see the enemy's artillery without letting him see us.' Well, this instrument is exactly the aeroplane. The aeroplane is able to serve us in three different ways. It shows the commander of the artillery all the ground in range of his guns, and the dispositions of the enemy, by means of a weighted report. After going into battery, it plays two important rôles, it will show the objective to a battery or a group of batteries, and it helps us to control our fire. The aeroplane coming from the rear of our battery, flies out over theirs, watches where our shells hit, circles back, and gives us the result by dropping a weighted card. In that manner it indicates objectives that we can not see, and gets the range under conditions that we have never realized until now. Here we have the results obtained by the aeroplane. Those who helped in this firing have been so enthusiastic that they have told it to everybody that is interested in flying. I will not go into details, although several daily papers have done so, because to my mind there are very serious reasons for keeping my mouth shut. We know the very simple means by which a battery is able to say to an aeroplane, 'I need a target, look for one' or, 'Just control my fire.' The results we obtained are such as to make our artillery so destructive that I ask you immediately to appropriate money for school instruments, instruments we can use in making a reconnaissance. The one hundred or one hundred and fifty aeroplanes that you will give us will be of wonderful value to our two frontier army corps. The armies that follow our example will have a great advantage over the others."

¹⁰ See in Illustration of Sept. 16, 1911, an article entitled "*l'Aviation aux manoeuvres de l'Est*"; see also, *Ueberall*, Nov., 1911.

maneuvers were favored by good weather. It would be a useful thing if we could have these wagons make a thousand mile "hike" in the winter time, the aeroplanes could fly around every day and the officers could deliver short talks on flying at every camp-site. It is desirable that these experiments be made at the worst possible times and during the worst possible weather, for by doing this they would get valuable experience and would be worth more on the battlefield.

We pass rapidly in review the conditions that these equipments of the artillery should fulfill in order to do the best work. We have already said that they must be monoplanes. Besides the advantages already pointed out, in employing monoplanes, we will not have to deprive the regiments of their officers to any great degree, for we already have detailed a large number of officer aviators. The artillery avion must be light in order to be placed in a wagon easily. The monoplane fulfills this condition. It must be able to get a good hold on the air so that the pilot can more easily attend to his duties as observer. In its design the various controlling devices must be arranged to permit driving with one hand, and consequently must all be controlled from a single lever-arm. Our avion does not need an extra-powerful engine because it is not supposed to make long trips. It must be able to ascend quickly, not only to avoid receiving the shells of the two lines of battle, but also to rapidly obtain a view. This condition is absolutely necessary in order to get the instantaneous information that an avion can procure, and which is so very valuable on the field of battle. The dismounting of an avion must be easy. Whenever it is taken apart, the mechanical difficulty must be reduced to a minimum, and the shape must not necessitate having a wagon too large and bulky. The assembling must be rapid, and for this reason it is necessary that the adjustment of the wings or plane be convenient and easy. The most important part, the motor, must be able to be changed easily. The field of view must be very extensive. All these conditions have been realized in the monoplanes in present use, by ingenious changes due to Captain Couade, of the Vincennes Aviation School.

Monoplanes will suit our purpose better than biplanes, but I will not say that a small biplane, well constructed and particularly easy to dismount, would not suit us also.

Whatever it may be, the Bleriot firm, being shown the desired shape, can build an apparatus that can fulfill the following

conditions:¹¹—When equipped for two hours' flying it can ascend at least 500 meters in five minutes, carrying with it a weight of 90 kilograms (pilot and accessories). (500 meters equal 1640 feet, 90 kilograms equal 198 lbs.) It can be unloaded and placed in flying condition in 15 minutes. In the same space of time it can be taken apart and loaded on the wagon. In 15 minutes the motor can be replaced by another. To make these changes we can use the two mechanics with the help of two of the wagon drivers.

I have not spoken till now of one essential condition that our avions must realize. It is necessary that they all be of one well tried type, because it is very important that in engines of war the different parts be interchangeable. A hundred identical mediocre machines are worth more than a hundred of the best models all different. But I know that in the present stage of aviation it is difficult to realize this condition.

Finally, the last condition, the avion must be constructed so as to guarantee reasonable security, and it is important that hereafter we inspect the apparatus at the factory as carefully as we do the other army equipment. We do not accept the steel in our bedsteads without unwinding a lot of "red tape," and it seems reasonable to act the same way about the materials used in constructing avions. It is not necessary to create a new detail for this work. Our battery-blacksmiths are all qualified to inspect this manufacture. Our marvellous aerial engine, having the qualities we have just enumerated, is sure to be an excellent avion.

However, it is unquestionable that the future has in store for us some pleasing surprises on the subject of progress that the science of aviation is capable of making. I am not willing to enter into a theoretical discussion and thus get away from my subject, but I want, nevertheless, to show you two important improvements that, to my mind, are necessary to increase the military qualities of our aeroplane:

1st. It seems to me indispensable to change the planes in use at present, which rapidly get out of condition when exposed for some time to dampness.

2nd. It seems to me that we should seriously study automatic balancing, so as to permit the employment of pilots of average ability for whom there will be a great call, when aviation becomes a little safer.

¹¹ See the *Matin* of Feb. 7, 1912.

Major Lucas-Girardville has looked for the solution of these two problems as follows:

1st. By using partly flexible planes capable of enduring safely the wear and tear of the hardships of a wet campaign.

2nd. In the construction of extremely exact and powerful gyroscopic-stabilizers.¹²

I note in passing that the same officer has studied a helicopter¹³ which I hope will be to the field-artillery the ideal aerial observatory.

But it is not enough for war to possess aviators, avions, wagons and their spare parts. It is necessary to group all these in suitable formations and supply them with the means to live.

The foundation of our formations, the aerial piece, is composed of one wagon with its avion. One aviator officer, mounted. One wagon-master, mounted. Three drivers. Two mechanics.

Three pieces under command of the ranking aviator officer constitute the aerial unit. One unit will be assigned to each regiment of artillery. Usually these units will march with the battery-wagons, forges, caissons, spare teams and so forth. The junior aviator officer will take station in the wagon column. The two others will remain with the staff of the colonel commanding the regiment.

Concerning the formations of the second and third lines I will only say to you that the third section of the army corps artillery park will carry necessary duplicates and will make all small repairs. Important repairs will be made at the main artillery park of the army. The method of supplying and replacing matériel will be the same as if it were artillery matériel. In other words, in every case treat an aeroplane as if it were a gun.

With respect to organization it will be the same in time of peace as in time of war.¹⁴ This principle has been followed in all kinds of mobilization, the necessity has been acknowledged in our field artillery, and it is foolish to try any new schemes.

A recent patriotic exhibition will indicate to you that which the good sense of the nation has suggested concerning this idea.

The French colony of London has just offered an aeroplane to Colonel Huguet of the artillery, Military Attache to the French Ambassador, for the use of the regiment of which he will soon take

¹² See *Revue d'artillerie*, March, 1911; *Aerophile*, Feb. 15, 1911; *Nature*, April 9, 1910, and March 4, 1911.

¹³ See the *Matin* of Feb. 7, 1912.

¹⁴ See in the *Journal* of Feb. 2, 1912, the article entitled "*Comment il faut organiser l'Aviation.*"

command. Those who have lived in a foreign country know how much the French who live there appreciate and find out for themselves the real needs of their mother country. This fine demonstration shows us very clearly the way in which we should interest ourselves in military aviation.

It is necessary that in time of peace the aerial units be constantly mobilized under the chief which they will have in war, so they will be ready to depart with their avions at a moment's notice.

No one would ever think of changing the mount of a cavalryman about to be sent into the field. The case is much more grave when he acts as an aviator, for it is impossible to quickly get used to the vibrations of a new machine, and every pilot prefers to fly his own apparatus and will often hesitate going on long trips in a new machine, even if it is the same type as his. We know how frail the engines are; and it is necessary, in order that the avions may be always in good condition, that every aerial unit in time of peace carry along one extra engine.¹⁵ It is to be noted that the organization described is easy to generalize and can apply itself to all the aviation of a battlefield.

I only intend that this unit can fulfill all requirements of the aviation of the artillery, of the staff of an army corps, and of the cavalry divisions. I omit here the aviation of the General Staff, as well as the aviation of garrisoned towns, fortified positions, and so forth whose needs are entirely different. It will be necessary to form an aerial unit for each kind of aviation thus defined. These units would be under the orders of their chiefs in time of peace and in war, and their material would be transported the same as in the artillery aviation. In this manner, with the minimum expenditures, without adding any more to the paper-work and "red tape," already sufficiently complex in our army, we may realize tomorrow the greater part of this so agitated question, military aviation.

Speaking of recruiting. I made the remark that when military aviation is well to the front, every arm must provide itself with its own needs. It will be easy to recruit its captain-instructors, its range-officers, musketry instructors, in general all its specialists.¹⁶

¹⁵ The units in time of peace will have to be given some biplanes for future aviator's practice and also to take up officers who want to observe.

However, the progress of aviation is so rapid that we will construct, without doubt, biplanes that will better suit the conditions enumerated. We will be able then to take up regimental or battery commanders when it is necessary to do so.

¹⁶ It is well understood that noncommissioned officers can take up the duties of an aviator. It is not a question of having a pilot-reserve of privates. They can be used in some other kind of aviation.

From time to time, let it be understood, the aviator officers on duty with their regiments can resume their studies at the great centers of instruction—veritable Saumurs of aviation—where by reason of the surroundings they will be able to perfect themselves in their difficult profession. With the exception of a few professionals or experts we will not count on aviator officers remaining through long years of service. The great majority will go back to duty with their regiments sooner or later, but they will be a great help in the field when the time comes to relieve aviator officers that are not able to do duty.

I do not speak of the subject of firing from an aeroplane, although they may some day be a help to the artillery in this manner. This is a thing that numerous students are investigating at present, but it has nothing to do with my subject and I do not want to take advantage of your patience. However, you will allow me, before I finish, to state two simple truths. The first has to do with many difficulties which the Vincennes Aviation School is trying to overcome. I have no doubt that other military aeronautical schools have these same difficulties. I will mention only the very great difficulties arising from the fact that, by virtue of a very poorly interpreted deed, the ground on which the school at Vincennes is built is not entirely under control of the military authorities. And because we live under an administration that is a joke we are unable to erect buildings and may be ordered off the ground any time on a year's notice! For this reason we are obliged, therefore, to keep our avions under canvas hangars that have already been through two winters. In spite of all this, our officers continued to fly with great courage. In the second case I will make a very modest but pressing appeal to the proper authorities to make artillery aviation enter the domain of realities. You remember that in 1870 we possessed artillery matériel, Reffye's matériel, which through delays in trying out has yet to make its first appearance on the field of battle. If we could have only had it at the desired time it would have given to our guns the superiority that the German guns had over ours. I have too much confidence in the intelligent patriotism of those who have the important work of making our army strong and efficient not to be assured that errors similar to those of 1870 will not be repeated in 1912, and that we will have hereafter the necessary number of avions and that we will know how to use judiciously the ones that we have already.

The organization of artillery aviation must be made step by step,

as we did in the case of the 75 mm. guns. We know our actual resources and the importance of artillery reconnaissance that will show itself in the first fight of the troops garrisoning the frontier posts. So it appears that the first thing we should do is to give to our two frontier army corps their twenty avions for artillery observation, with all the personnel and matériel that they will need. Above all things, we should not let our near neighbor get ahead of us in this subject.

I will feel well repaid if I have succeeded in proving to your satisfaction even a small part of the value of artillery aviation, which is in shape now to increase tenfold the effects of our already formidable guns. May the efforts I have just analyzed not remain fruitless, and may they help us to get our revenge!

That is the only purpose of the Aviation School at Vincennes, and it is to realize this that we labor with the artillery so diligently, in time of peace for the sake of the army, for the sake of France!

FRENCH ARTILLERY.

BY GEORGE NESTLER TRICOCHÉ, LATE LIEUTENANT FRENCH FOOT ARTILLERY.

The recent movement in favor of the Pom-pom (50-millimeter field gun).

At a time when in so far as the artillery is concerned, the struggle between France and Germany seems to be a contest of efficiency between rapid fire guns and howitzers, it may be interesting to study a proposal made a short time before the present war concerning the composition of field batteries in the French army. We are referring to the proposed elimination, more or less complete, of the 75-millimeter gun and the adoption of a high muzzle velocity extra rapid fire gun, the 50-millimeter "pom-pom." It is interesting to note that this proposal is nothing but an extension—not to say an "adulteration"—of the ideas of that great French artillerist, General Langlois, who was the first to advocate the use of the pom-pom in his country, but who wished to add only two of these guns to each 75-millimeter battery.

Let us see first why such a gun was considered desirable, and then what considerations prompted General Langlois to limit to two pieces per battery the number of pom-poms.

Today field guns are provided with shields and hide themselves from view in rear of crests, behind elevated roadways and the like. Therefore, in order to hit them, it is necessary to search greater areas than formerly. Against shielded guns one must use high explosive shells, and as their effect is comparatively local, their use increases the number of rounds required to neutralize or destroy the hostile batteries. But as the number of caissons seems to have reached a maximum, a logical conclusion would indicate the desirability of the adoption of a smaller caliber field gun—50-millimeter, instead of 75—which would enable batteries to carry more ammunition, and thus be better prepared for the searching of areas. It is obvious that such reasoning has no value whatsoever unless the efficiency of both guns is the same. The supporters of the "pom-pom" contend that such is the case. According to them, the high explosive shell of the 50-millimeter would weigh 1.6 kilogrammes (3.52 pounds), and contain 250 grammes of explosive (gr.=15.43 grains). Nobody denies that this shell would be sufficiently effective against shields, cannoneers behind the shields and matériel itself.

And one should not lose sight of the fact that the total number of projectiles—high explosive and shrapnel—would be three times as great as with the present 75-millimeter gun.

However, General Langlois, who spoke in favor of the "pom-pom" in his well-known book *L'Artillerie de campagne en liaison avec les autres armes*, and who again took up the question in 1909, at the time of the field artillery reorganization, never asked for the suppression of the 75-millimeter gun. All he wanted was, as we have already said, the addition of two "pom-poms" to each battery. Whether he intended the battery to have thus eight or only six guns has not been made very clear, and is of little importance. The opponents of the "pom-pom" give us the following reasons why the general did not wish to do away entirely with the 75-millimeter gun. They contend that the shrapnel of 50-millimeter "pom-pom" which would weigh 2.2 kilogrammes (4.84 pounds) and would contain twelve gramme bullets, would not be powerful enough as far as depth is concerned. Three "pom-pom" shrapnel would not be worth one of the 75-millimeter caliber (against troops in the open). Therefore this gun can be considered efficient only when firing high explosive shell and the latter, being lighter than those of the 75-millimeter gun, could not be fired with equal advantage against houses, garden walls, or woods. Their use, in the general's mind, was evidently limited to fire against shielded guns and caissons. Moreover, owing to the light weight of the 50-millimeter projectiles, it would be necessary to have a high muzzle velocity in order to obtain the same range as with the 75-millimeter gun, the shell of which is heavier, and to throw the same total weight of projectiles upon a given zone in a given time the rapidity of fire ought to be about seventy-five or eighty shots per minute. Now, the combination of a great muzzle velocity with extreme rapid fire has at least three drawbacks: it wears out the gun prematurely, it requires a complicated machinery, and it requires also heavier matériel to withstand the increased pressure. A field artillery force consisting entirely of "pom-poms" would be quickly out of commission. Another consideration is that with the "pom-pom" adjustment of fire becomes a difficult problem, for the shells are small, and it is not easy to see the bursts. This, more than anything else, led General Langlois to prefer the "pom-pom" used simultaneously with the 75-millimeter gun—the latter being made a sort of range finder for the "pom-pom" whenever it seems advisable to fire the two 50-millimeter guns of the

battery. Naturally this proposition has been criticized as being more theoretical than practical. We read in the *France Militaire* (June 2, 3, 1914) that some officers went as far as to say: "Observations made by the best range finder known always need a verification, which is the object of the fire for adjustment. What would be the verifying element for that particular kind of range finder? The aeroplane?" We mention this reasoning only to show what amount of quibbling has been done on that subject. Furthermore, it is hardly necessary to point out that the co-existence of two calibers in each battery would greatly complicate the ammunition supply, especially in the ammunition sections.

Finally, the work of the Aviation Corps and especially the use of artillery avions, which enable the battalion commander to discover the enemy's positions neutralize considerations favoring the use of "pom-poms," since the aviator's observations lead to a reduction of the area which the artillery has to search.

Such are the arguments set forth against the "pom-pom." Let us see now what is the answer of the most radical supporters of that gun—that is to say, those who go farther than General Langlois and who started a campaign in favor of the 50-millimeter gun a few months before the present war. They propose either the armament of all light batteries with "pom-poms," or the creation a majority of "pom-pom" batteries, and thus do not mix calibers in field batteries, and do away with the objections referring to the ammunition supply. In this case there would be no more difficulty in regard to ammunition than with the present division into light and howitzer batteries; and it would only be necessary to organize a special echelon in the ammunition sections. To do away with minor objections, we must add that the argument referring to aeroplanes is not considered serious. It is not true the use of artillery avions would reduce to naught the usefulness of "pom-poms." The French regulations state positively that one should not try to obtain a bracket smaller than one hundred and fifty meters when the fire is supposedly adjusted. It is necessary during fire for effect to beat a surface one hundred and fifty meters deep and this affords a good opportunity for taking advantage of the "pom-pom's" qualities: extra rapid fire, larger number of shots, and, often as we shall see later, economy of fire.¹ The alleged inefficiency of the 50-millimeter

¹ We might add something to this reasoning. Little as we know about the teachings of the present war, we know at least this: observations are not made

shrapnel is a more serious objection. The shrapnel should weigh as stated before, 2.2 kilogrammes, or perhaps 2 kilogrammes. Of course, under these conditions, the number of bullets is smaller than for the 75-millimeter shrapnel, which weighs 7.025 kilogrammes. It is also true that the proportionate dead weight of the shell's body is increased, but it is possible to use this superior weight as a prop or support to increase the bursting charge and, as a consequence, the velocity of the shrapnel bullets. The supporters of the "pom-pom" contend that this will make the efficiency of the 50-millimeter shrapnel at least equal to that of the 75-millimeter. This efficiency will be even greater if the projectile is given a muzzle velocity of 638 meters (2092.5 foot-seconds) because in that case the trajectory will retain up to 6000 meters, an angle of fall smaller than that of the 75-millimeter gun. The remaining velocity will be higher, and the angle made by the cone of dispersion with the ground will be smaller.² With reference to the wearing of the gun, caused by a very high muzzle velocity, the answers made to this objection do not appear to us quite satisfactory.

In the last papers published before the war—which, of course, cut short the polemic on this matter—some of the "pom-pom" supporters say that their object, in general, is to obtain an extra rapid fire for effect, rather than to cover a given zone with more projectiles than formerly. This would show a great divergence of views among the advocates of the "pom-pom." The oldest ones, who, as well as General Langlois, were mostly theorists in that respect, and did not worry much about the ordnance part of the question, were attracted by the possibility of a more extensive searching

from aeroplanes as easily in war time as during maneuvers—far from it. Many aviators, belonging to the different nations now fighting, have said that they are unable to see many details, because it is necessary for the aeroplane to remain too high in the air, in order to avoid being hit by bullets. It is not likely that a battalion commander will ever be able to rely almost exclusively on artillery avions to adjust his firing. The airman's help may always be considered as exceptional.

A good illustration of the difficulty of observation by aeroplane is found in a fact that has been reported, lately, from the line of battle, in the north east of France. In the central part of this line, not far from Rheims, a French battery was well hidden and the German artillery could not discover its position for several days. Aeroplanes were used, but *without the slightest success*. Had it not been for the cleverness of a German spy, the battery's position might never have been disclosed. The spy, disguised as a washerwoman, hung out some white linen, one morning, a short distance behind the battery and, at last, the German airmen could find the exact emplacement of the French guns. (Correspondence of the *New York Evening Post*.)

² In French: *La rasance de la garbe sera augmentee.*

of the enemy's positions. The other ones, more radical and more scientific, are reckoning with practical difficulties, and are content with a more rapid searching. These, after considering to some extent the ballistic problems connected with the 50-millimeter "pom-pom" declare that nowadays, without being branded as an idealist, one can expect the ordnance officers³ to find a way of preventing the premature wearing of the gun, and to build a gun carriage able to withstand the effects of a high muzzle velocity without any increase of weight. But they say it would be absolutely sufficient to obtain, in a much shorter time the throwing of the same number of shells upon the same surface as with the 75-millimeter gun. During the fire for effect, the 75-millimeter gun beats a surface of one hundred by one hundred and fifty meters, in a satisfactory manner, with one hundred and fifty shells. The four "pom-poms" of a battery could throw these 150 projectiles in forty minutes, which is not an excessive rate of fire. The gun, under these circumstances, would not likely become more overheated than the tubes of the machine guns. In regard to the difficulty of adjusting the fire, it is not true that the fire of the "pom-pom" would be difficult to adjust. We have seen that the bursting charge of the shrapnel will be increased and as regards high explosive shells, there does not seem to be, *a priori*, much ground for asserting that the difference in size between the projectiles of 75-millimeter and 50-millimeter would be sufficient to make more difficult the observation of the "pom-pom's" bursts. The truth is that, on account of the dark color of the smoke made by the slow burning bursting charge, the observation of bursts is difficult for all high explosive shells of field guns. But, will it not be possible, some day, to give to that powder a lighter color?

Besides, there are elements that will increase the accuracy of the "pom-pom." With a muzzle velocity of six hundred and thirty-eight meters, the angles of fall, up to six thousand meters, being smaller than those of the 75-millimeter gun, the vertical deviation (*écarts probable en hauteur*) will be lessened. Secondly, as the deviation of the fuse is about proportional to the length of combustion or

³ We use here this expression to avoid a misunderstanding. But it must be remembered that there is no Corps of Ordnance in the French army. Artillery officers from the *Ecole Polytechnique* are usually detailed, as 2nd captains, with some "Artillery Establishment"—like Bourges, or private foundries, where they superintend the making of guns, small arms, etc. Those who have a liking for ordnance work get, as a rule, a permanent detail.

to the time of flight, when both are reduced, a better working of the fuse is assured. It must be observed, too, that the reduction of the time of flight, coupled with a greater accuracy of the gun, will reduce the length of time necessary for fire adjustment.

After replying to the accusations made against the "pom-pom," the supporters of the latter call our attention to the following facts:

First. The projectile of the future is the high explosive shell, fired either with or without a time fuse, rather than the shrapnel, because the artillerist of today is looking, above all, for the potential efficiency of the shell. Now, this kind of energy is still rather small with the 75-millimeter shrapnel, for the weight of the bursting charge of this projectile is only one-sixth of that of the propelling charge. This explains why the bullets of the 75-millimeter shrapnel so often inflict light wounds.⁴ For that reason, many French artillery officers, and especially General Langlois, are much in favor of a very high explosive shell, for instance, the torpedo-shell⁵ which contains a melinite charge seven and one-half times larger than that of the black powder charge of the 75-millimeter shrapnel. The high explosive shell, for some officers, is a true panacea!⁶ It annihilates vertical covers, such as shields and trenches. Just at the time of the last mobilization, it was advised to use it against lines of skirmishers in connection with shrapnel, the latter preventing infantrymen from standing up, and the torpedo-shell preventing them from remaining in a prone position. However, it must be borne in mind that high explosive fire is comparatively slow and certainly expensive. It is therefore very important to have a shorter fire for effect, and more rounds of ammunition. The 50-millimeter "pom-pom" fills both conditions. In the opinion of these officers, whose views differ widely from those of Lieutenant Colonel Paloque, as expressed in *L'Artillerie dans la bataille*⁷ a heavy shell is not needed. General Langlois himself wrote, "A torpedo-shell of the weight we now use is *too energetic*. In a very

⁴ This is still more true with the Krupp matériel, the shrapnel of which has a smaller charge than the 75 millimeter gun. We see the fact repeatedly mentioned in the Medical Reports of the Greek Army for the Balkan war, as regards the effects of the Turkish shrapnel. In a paper written by a Swiss military surgeon detailed with the Greek army we read about a Greek soldier who was struck by eighteen shrapnel bullets and returned to the front, cured, within a few days (*Revue Militaire Suisse*, 1914).

⁵ See "Influence de l'obus-torpille," by General Langlois.

⁶ *France Militaire*, June 16th 1914.

⁷ See THE FIELD ARTILLERY JOURNAL for July-September, pp. 345, etc.

limited sphere of action with a projectile of *one kilogramme* (37 millimeters) the beaten surface will be the same but the density of hits upon that surface will be more convenient." He said again, elsewhere, that one should not have only in mind the destruction of covers, for "the artillery must continue to seek the defender, not the obstacle behind which the defender hides himself." He does not think that the bullets should pass through the shield to hit the cannoneers.

Second. A muzzle velocity of six hundred and thirty-eight meters, which, up to six thousand meters, reduces the time of flight, would also on account of the smaller angle of fall, permit us to take advantage of ricochet hits in percussion fire, more often and under better conditions than with 75-millimeter gun.

Third. The deviation *en direction*, up to six thousand meters, would be noticeably smaller; therefore, the limit of range for the fire for demolition could be increased from thirty-two hundred meters (75-millimeters) to four thousand meters.

Fourth. The power-minute of the 75-millimeter firing twenty-five rounds per minute is 103.3 ton-meters by 25 equals 2582 ton-meters. To equal this all that is needed for the "pom-pom" is a rate of fire of sixty-three shots per minute.

Fifth. A high *debit-minute* (rate of fire per minute) should not handicap a rapid graduating of the fuse. The automatic fuse graduator—is it really automatic?—is twenty-five years old. It may be permitted to suppose that ordnance officers or other officers interested in such problems could find a way to improve either the graduating or the fuse.

Sixth. The 50-millimeter caliber "pom-pom" would be, in fact, a more conservative innovation than the gun contemplated by General Langlois, which, as may be seen in the quotation above, was a 37-millimeter "pom-pom."

Such was the "pom-pom" question at the end of last July. It will be very interesting to see what influence the teachings of this war will have upon the future of the proposed 50-millimeter gun in the French army.⁸

⁸ As we were writing this, we came across a clipping from a military periodical several years old, referring to a polemic between the German Generals von Reichenau and von Alten. The latter contended that, against shielded matériel, such as the present French 75 millimeter gun, one ought to use a light, very mobile gun of a very small caliber (50 millimeter), with an extra high explosive shell, bursting on impact.



DUMMY DRILL BATTERY FOR MILITIA FIELD ARTILLERY.

Few officers in the regular service realize to what crude expedients militia field artillery officers are driven in their attempt to train their drivers in the rudiments of battery drill movements when no horses are provided for their use except at the annual camp and field service.

The difficult and discouraging problem involved has been solved by Captain D. Myron Etheridge, commanding Battery B, Field Artillery, Organized Militia of Virginia, by the construction of small wooden carriages as shown in the illustration above.

The carriages are made of yellow pine and are of the following dimensions:

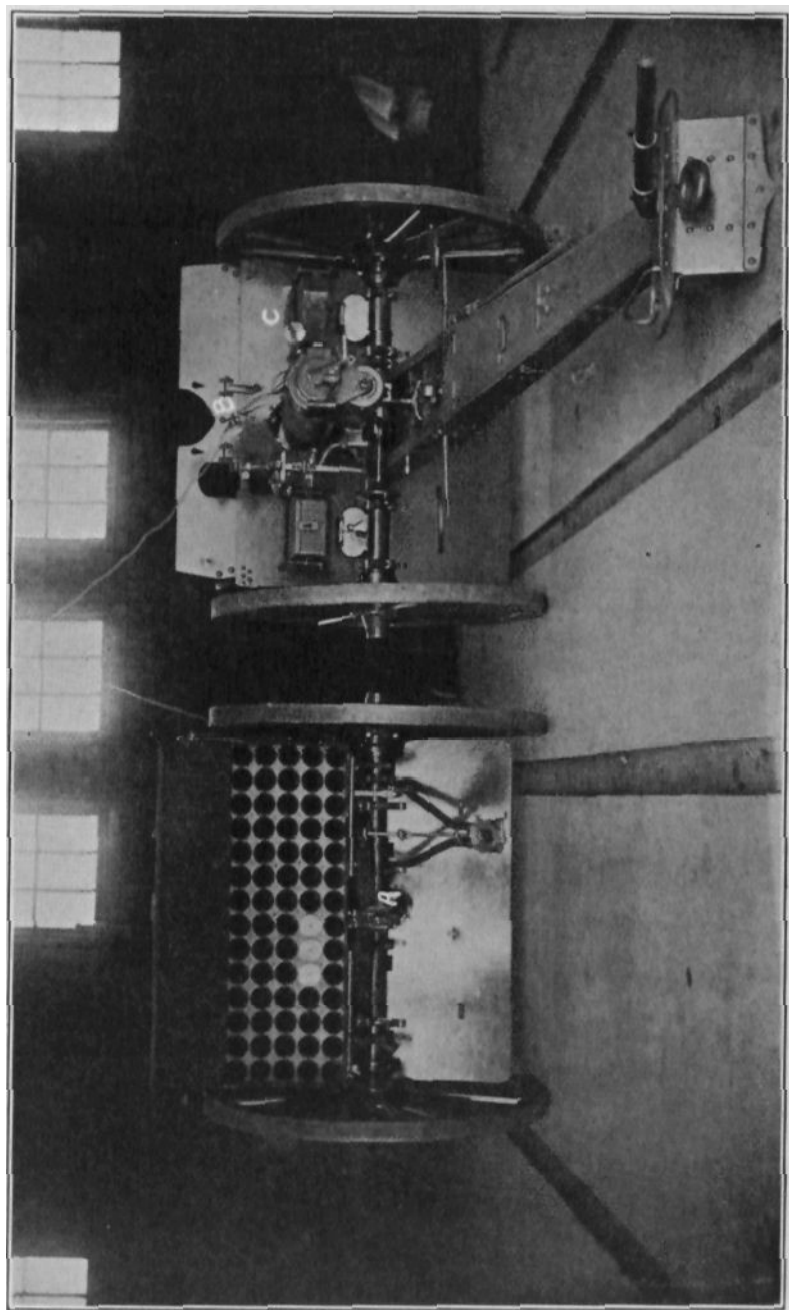
Length of Piece	4 feet
Length of Caisson	3 feet
Length of Limber	5 feet
Width of all Carriages	2 feet 6 inches
Limber and Caisson Chests	2 feet by 8 inches by 8 inches
Length of Gun	2 feet
Diameter of Breech	4 inches
Diameter of Muzzle	2½ inches
Wheels	10 inches diameter, 2 inches thick
Axles	2 inches square, 2 feet 6 inches long
Cost for entire battery	\$20.00

All carriages are designed to limber and unlimber with staple and hook.

By requiring lead drivers to haul the carriages, and insisting upon officers and noncommissioned officers giving the proper commands

and arm signals, the battery can be made sufficiently familiar with the elements of mounted drill to be ready to execute battery movements after instruction in the management of the single horse, the pair and the team.

That any mounted command should be forced to such primitive expedients is a reflection upon our military system.



LIGHTING SYSTEM FOR MILITIA BATTERIES.

The problem of lighting the sights, quadrants and fuse setters of militia batteries for armory drills has been solved in various ways, and many forms of ceiling and swinging lights have been devised and installed; but it has been found that ceiling lights seldom give sufficient illumination and that swinging lights are sometimes confusing on account of moving shadows.

A system of lighting devised by First Lieutenant Fred S. Swier, Battery C, Field Artillery, Organized Militia of Pennsylvania, has been installed in the armory at Phoenixville, Pennsylvania, where it is giving excellent results. The lights being small and securely fixed have none of the disadvantages of the other systems referred to.

The system is very inexpensive and simple. An insulated wire cord is dropped from a socket in the ceiling to a point over each section. A few feet above the carriages the wire branches in two directions, one leading to the piece and one to the caisson. The device for holding the lamps and reflectors in position to throw the full rays of light upon the instruments consists of common iron bands one sixteenth of an inch thick and three quarters of an inch wide, which can be readily bent to fit on the desired part of the carriage. On the gun the band is double and is held between the shoulder guard of the gun, one piece being bent toward the sight and the other extending to the right side of the gun for lighting the quadrant. On the caisson a six inch piece of band is used and is fastened at the junction of the two rails and the pintle by wires. The lamps used are 110 volt, 4 candle power miniature lamps, using the same current as the rest of the building. Each lamp is furnished with a small tin reflector.

The cost of material for four sections is \$15.00. The work of adjusting and fitting can be done by the battery mechanics.

In the illustration on the opposite page. *A* indicates the fuse-setter light; *B*, the light for sight; and *C*, the light for the quadrant.

CONVERSION TABLE MILLIÉMES TO DEGREES, MINUTES, AND SECONDS.

BY LOUIS J. SCHROEDER, ORDNANCE OFFICE, WAR DEPARTMENT.

Note—The several difference columns apply only to the mils and degree columns to their immediate left.

Millièmes to Degrees.

Opposite the value in the table just below the value sought will be found the number of full degrees in the value sought.

For the difference between the tabular value and the *sought* value, the equivalent number of minutes and seconds will be found in the difference column to the immediate right.

It will be noted that a difference of 0 will have an additive value in all columns but the first.

Degrees to Millièmes.

In the milliémie columns the value for any given number of degrees will be found.

In the difference column immediately to the right of any value is given the number of mils for the number of minutes and seconds nearest to the remaining number of minutes and seconds.

It will be noted that the value in mils for an even number of degrees will be in excess by the number of minutes and seconds opposite the 0 difference in the corresponding difference column.

CONCERNING THE FALL OF THE BELGIAN FORTS.

BY H. ROHNE, LIEUT. GENERAL.

Although all technical details of the 42-centimeter mortar are omitted, the reputation of the writer adds great interest to this brief sketch which is one of the first authentic references to the great ordnance surprise of the present war.

During the Franco-Prussian War, 1870-71, the German foot artillery was in action against sixteen French forts. Among these there were only three, which, according to the standards of that time, could be designated as modern forts. These were Metz, which held out for ten weeks; Paris, offering resistance for four months and surrendering through starving out; and Belfort which withstood for three months and fell only after a regular siege. All other forts, even Strassburg, were not up-to-date; they lacked the protective outer belt of fortresses, so that the main attack could immediately be directed against the city walls. Nevertheless, Strassburg fell only seven weeks after the first appearance of German troops.

How entirely different is the aspect furnished by the assault upon the Belgian forts! On the sixth day after the beginning of the mobilization, the German flag was unfurled over five of the Liege forts and a few days later the entire fortified town was in possession of our troops. Namiur fell as quickly, if not more so, although the enemy had the opportunity of improving the protection of this fortress over that of Liege.

Both these fortresses were constructed by the foremost strategical architect of the world, General Brialmont, upon entirely modern principles, and surrounded by a belt of forts, which almost precluded a shelling of the city unless the forts were taken first; all of the forts were protected by armor and equipped with modern heavy guns, in spite of which they succumbed after such a short period of shelling, so that even the artillerymen, who are generally believed to over-estimate the efficiency of their guns, were completely astonished.

From the experience of recent wars, particularly the siege of Port Arthur, the principle was evolved that a modern fortress could be taken only by infantry assault, approaching under cover and having its way cleared by artillery. Artillery experts and engineers calculated the number of ammunition wagons required for the destruction of the small targets represented by guns under armor protection,

and arrived at figures which are hardly credible and an extremely long time required for the combat. Very natural! because each projectile which missed the small target was—in view of the purely local effect—wasted and only a very, very small percentage would actually hit.

Before Liege a different method was employed for the first time. Instead of using a large number of small projectiles, one very powerful projectile was thrown into the fort, which produced such an immense effect that one hit was sufficient to destroy all the guns of the fort at once, and thus break down its resistance. This is clearly shown by the published photographs of the fort turned into a pile of wreckage. The close fight during the last half century between guns and armor has been decided, probably conclusively, by the recent results in favor of the gun.

This is not the proper time to furnish further details, suffice it is to say that this result is due to the 42-centimeter mortar whose bore is twice as large as that of the largest caliber gun of the land artillery. This step is most interesting and shows great courage. In the line of naval artillery the Krupp firm first constructed 24-centimeter guns, then 28, 30.5, 35.36, 38.1, and finally 40.64-centimeter guns, that is six different groups, and has not even reached the 42-centimeter caliber. The gifted engineers of the Krupp Works, who worked out the plans of this world wonder and then actually constructed it are entitled to the thanks of the Fatherland. Without these guns, streams of blood would have had to flow—as in the case of Port Arthur—before the doors of the two forts would have been opened. What valuable time—the most essential thing in such an energetically conducted war—has been saved and how many other fortresses will have to surrender after the first greeting from this giant gun!

CURRENT FIELD ARTILLERY NOTES

The Austrian 30.5 Centimeter Field Mortar.

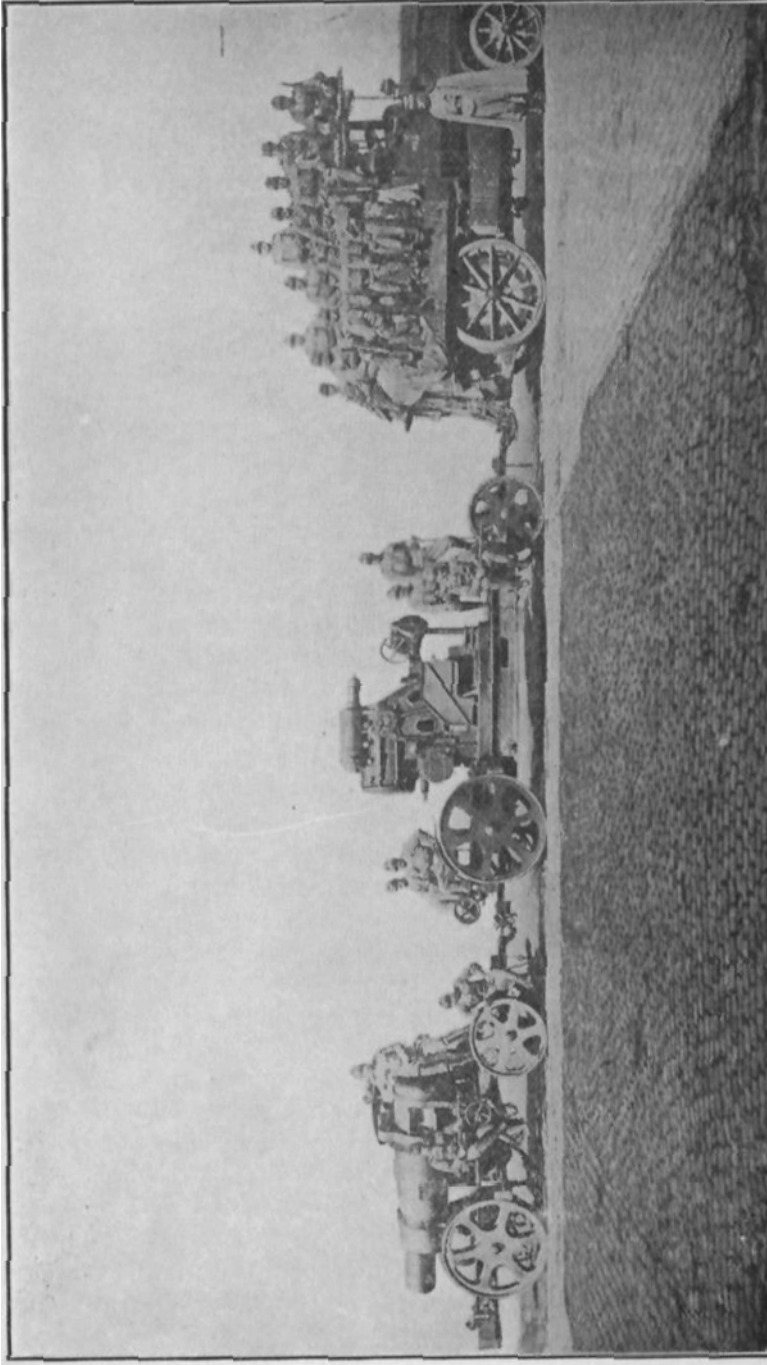
So much attention has been attracted by the German 42 centimeter field mortar, that little has been heard of other ordnance of great power which is, in some ways, as interesting as the huge German mortar about which almost nothing is known in this country even today.

The Austrians take great pride in their 30.5 field mortar, and maintain that its successful development on a motor-drawn carriage is a greater triumph of ordnance engineering than the construction of the German 42 centimeter mortar which, it is understood, is transported by rail.

This mortar is built by the Skoda Works in Pilsen, and is designed to be transported by a one-hundred horse-power Austro Daimler motor and three trailers as shown in the illustration on the opposite page. The trailers are designed to carry the gun, the carriage and the bottom plate or base separately. The construction is so ingenious that the gun and carriage can be unloaded and assembled for firing in from forty to fifty minutes. It can be disassembled and prepared for transportation with equal facility. In case of emergency it can be used without its bottom plate or base, provided a strong, hard road-bed is available for its support. Its dimensions are relatively small, and it can be readily concealed and makes a difficult target.

The great success of this mortar at Namur, Givet and Maubeuge was not a surprise to those who were in the secret. The forty-two centimeter German mortar demonstrated its greater power at Lutich where it was brought by rail, but the Austrian mortar was employed alone at Givet and Maubeuge in positions where the German mortar could not have been used.

One or two examples will show the wonderful mobility and power of this mortar. On August 20, 1914, immediately after detraining, two Austrian batteries equipped with this mortar were put in motion and made a march of thirty kilometers the first day, a march of twenty kilometers the second day and on the third day they opened fire on the forts at Namur. After three days of bombardment. Namur fell. The batteries were then disassembled, transported



AUSTRIAN FIELD MORTAR.

Characteristics: Caliber: 30.5 centimeters (12 inches). Weight of projectile: 380 kilograms (838 pounds). Bursting charge: 40 kilograms (88.3 pounds) ecrastrate with an additional of trinitrotolol. Extreme Range: 7000 meters (7655 yards.) Maximum ordinate: 4000 meters (4374 yards). Penetration in concrete 8 feet thick: 19.7 inches. Effect of explosion on this concrete resulted in its total destruction.

sixty kilometers and opened fire on Maubeuge on August 29. Maubeuge fell on September 8. The small number of rounds which were required to reduce these fortresses indicates not only the accuracy of these mortars but the efficiency of the Austrian artillery which served them.

The characteristics of the gun, as far as they are known, are shown under the illustration.

British Anti-Aircraft Detachments.

The organization and equipment of anti-aircraft detachments followed naturally the successful use of aircraft of all descriptions in offensive and defensive warfare. The improvised equipment assigned to recently organized anti-aircraft detachments in the British army is of considerable interest.

The detachment consists of one captain, one lieutenant and sixteen enlisted men. The matériel consists of one London motor-bus chassis complete, on which is mounted a thirteen-pounder, quick-firing gun such as is used by the Royal Horse Artillery. These guns are mounted on a special carriage designed by Messrs. Armstrong, Whitworth and Company, and have an angle of elevation up to seventy degrees. The guns are fired with the vehicle pointed longitudinally.

In addition to the motor-bus carrying the gun, a detachment is provided with four other motors for the transportation of the detachment.

These anti-aircraft detachments are becoming very popular commands because they have been made practically independent in order to give them the necessary freedom of action in selecting sites for operation.

Exclusive Manufacture of Shell in France.

Reliable information has been received to the effect that the manufacture of shrapnel in France has been discontinued and that the Field Artillery is relying almost exclusively on the melinite high explosive shell.

NOTES REPRINTED FROM SCHOOL OF FIRE NOTES FOR
OCTOBER, 1914.

Optical Equipment, Field Artillery.

1. Commencing with the spring, 1912, term of the School of Fire, the opinion of officers of the Field Artillery present as students has been almost unanimously in favor of the replacement of monocular telescopes by scissors observing instruments. Numerous reasons for the substitution have been reported by informal boards. Scissors observing instruments should now be issued, without unnecessary delay, to regiments, battalions and batteries. Issue should not be delayed for modifications not absolutely necessary. Instruments of the above types, now available or early procurable, may, if obtained, be kept in service even though instruments better in principle or improved in detail should be developed later.

2. An efficient observing instrument on a fixed mount is necessary to secure the following advantages:

- (a) Certainty of remaining on the target, once identified.
- (b) Accuracy of observation due to steadiness of mount and operator's independence of nervousness due to fatigue and, largely, of weather conditions.
- (c) Freedom of observer's hands.
- (d) Relief from fatigue.
- (e) Rotation of observers without loss of identification of target.
- (f) Safety of observer through use of cover and immobility.
- (g) Higher power, greater field.
- (h) Auxiliary instrumental devices.

3. Binoculars have over monocular instruments the following advantages:

- (a) Stereoscopic effect.
- (b) Reduction of visual fatigue.
- (c) Wider field of view.

4. One type has the following good features:

- (a) Inexpensiveness.
- (b) Portability on saddle horse and constant availability.
- (c) Moisture and dust proof.
- (d) Accuracy of leveling not essential.
- (e) Level not liable to derangement.

- (f) Deflection scale fully exposed.
- (g) Independent angle of site device.
- (h) May be quickly set up.
- (i) Offers great advantages of securing cover.
- (k) Facility of adjustment of eye pieces.
- (l) Good light and definition.
- (m) Few and fine lines on reticule.

On the other hand, the following disadvantages were once reported:

- (a) Instability of attachment to tripod.
- (b) No adjustment for parallelism of lines of sight.
- (c) Inadaptability for carriage in limber chest.

It is now thought that the attachment to tripod is satisfactory and that the great adaptability of the instrument for carriage on a saddle horse is more important than facility of carriage in a chest. It does not appear likely that adjustment for parallelism of lines of sight can be provided for at posts or in the field.

5. A comparison has been made of several instruments of scissors type, all similar to one another, and a binocular telescope different from the scissors type in that the objectives are at the ends of a fixed bar.

6. Opinion is not favorable to the adoption of the bar telescope, as it is thought that the extra command of the scissors instruments is not compensated for by a possibly decreased liability to derangement of the optics. The optical qualities of this new and unused instrument, while much superior to those of the old battery commander's telescope, appear to be no better than those of the scissors type, which have been long used under service conditions.

7. To the scissors types the following objections are found:

To the * * *,—none.

To the * * *,—the deflection circle is too small, does not stand hard usage, has marked lost motion; tripod is unsteady, loses its screws and is liable to injury preventing the legs from telescoping.

To the * * *,—ball and socket leveling device stiff and difficult to operate, with no means of control by friction clamp while in use; angle of site device poorly located, requiring too long a case and carrying level too high for convenient observation of bubble; deflection circle permanently attached to optical parts, interfering with balance of load, requiring telescope case unnecessarily large and, in case of injury, causing loss of use of optical parts during repair;

locking device for telescope arms and tilting screw so located as to increase bulk of instrument; dioptric scale graduations different from those commonly used; deflection scale set screw badly located and too small; packing case heavy and unsuitable for carriage or horseback. The instrument shows a distorted image and optically appears to be less efficient than the others. There is doubt of the strength of construction at the smaller ends of the telescope tubes.

8. The best features of all the instruments can probably be combined in one, but enough should be procured, with the least practicable delay, to supply at least each battery, battalion and regiment of the army.

9. The aiming circle is a universal focusing telescopic instrument of low power for measuring deflections and angles of site. It is provided with a compass. There is no detailed record of tests, but its use in the School of Fire course has established its efficiency. Its adoption is recommended for the use of chiefs of the fifth section. It is considered to be necessary in order that the battery commander's instrument, primarily an observation telescope, may be used in observation of fire or of terrain without interruption for the measurement of angles necessary for the calculation of firing data for targets or registration points. It is possible that more than one of these will prove desirable for each howitzer battery, but opinion is reserved on that point. The aiming circle is small and light, can be readily transported by a man on foot or mounted and is easily and quickly set up, and is peculiarly suited to use as an aiming point when one is needed near the position. (S. of F. for F. A., October, 1914).

Range Finders for Field Artillery.

1. The object of the issue of range finders, observing instruments and aiming circles is to place immediately in the hands of regular Field Artillery troops necessary instruments of great usefulness, practicability, accuracy, portability, serviceability and convenience, without the delays so often resulting from a search for perfection of details and from efforts to overcome all objections offered to instruments even of marked efficiency and to incorporate all suggested features or improvements in those already, in the main, complete.

2. Prolonged use of self-contained base range-finders in the School of Fire indicates that they will give extreme satisfaction

under intelligent application and that their expert use will save an enormous amount of ammunition and, consequently, time and expense in securing effect.

Following are their advantages determined:

- (a) Operation by one man at a single position.
- (b) Great speed of operation—almost instantaneous.
- (c) Simplicity.
- (d) Suitability for all terrain.
- (e) Applicability against moving targets; easy determination of direction of movement of hostile or friendly troops.
- (f) Determination of depth of deep targets.
- (g) Usefulness on tower or observing ladder or elevated point.
- (h) Reduction of long bracket to two hundred yards, a bracketing or mixed salvo being obtained in fifty per cent of first salvos fired at range-finder range.
- (i) Probability of obtaining effect at first or second salvo or instantaneous, disappearing or moving targets.

3. It was recommended that an instrument be adopted with: (1) Protected stadia adjustment; (2) smoked glass cover for eyepiece; (3) deflection measuring device; (4) independent angle of site device; (5) cases for transportation on saddle-horse; (6) yard graduation of range drum.

4. Such range-finders, with the modifications suggested, or, if great delay will result in obtaining them, without the modifications, should be immediately procured and issued, one to each battery of field artillery in service. Their necessity is sufficiently established to warrant this. Even though it may prove desirable, as a result of the general test and the reports which would follow, to incorporate changes later on in these or subsequently obtained instruments, the expense will be amply justified by the results. While the instruments recommended will prove very satisfactory to the field artillery service, the furnishing of the range-finders to militia batteries and for batteries in store may be postponed until the field artillery service at large has had an opportunity to report the results of its experience.

5. The instrument should be carried with draught artillery on and off team horse, with mountain artillery on a pack mule. No special device is believed to be necessary for the latter, but for the former will be required a frame securely and firmly adjustable to any saddle, perhaps, also, a cargo cincha, carrying the range-finder on one side, the tripod and adjusting lath on the other. The two

parts should ride horizontally in light cases, one containing the tripod and lath, the other the range-finder, readily removable from the frame on the team horse saddle and attachable to the saddle of the soldier charged with the use of the instrument. On the latter saddle the parts should ride on opposite sides of the riding horse, in rear on the cantle, in an approximately vertical plane. A special attachment should be devised for this saddle to which the cases may be quickly attached and from which they may be quickly detached. Lightness, balance and quickness of attachment and detachment are requisites. (S. of F. for F. A., October, 1914.)

Field Glasses.

1. During the courses of instruction at the School of Fire in the fall of 1913 and the spring of 1914, seventeen types of glasses of from 6X to 12X were tested. Upon these tests, of which there were one hundred and forty-five thousand, nine hundred and sixty-nine recorded observations, the opinion is based that no field glasses with simultaneous focusing adjustment, narrow field of view or of less than 6X or more than 8 should be issued for field artillery reconnaissance or observation fire.

Recommendations:

(a) The discontinuance of the issue of any field glass for the use of officers of Field Artillery.

(b) The requirement that all Field Artillery officers own and provide their field glasses, which shall have at least 6X and a field of view of at least ninety mils; and shall be dust and moistureproof and of even illumination and definition.

(c) The issue of glasses for the use of enlisted men, as follows:

Organizations	Sergeant major	Sergeants	Agents		Scouts			Signal details			Totals
			Sergeants	Corporals	Sergeants	Corporals	Privates	Sergeants	Corporals	Privates	
Regimental Hdqrs	1	.....	2	.....	1	2	3	1	.....	1	11
Heavy Field Art'y Battalion Hdqrs	1	.....	.....	2	.....	3	3	.....	1	1	11
Light, Horse and Mountain Artillery Battalion Hdqrs	1	.....	.....	3	.....	3	3	.....	1	1	12
Heavy Field Art'y Battery .....	.....	5*	.....	.....	.....	1	1	.....	1	2	10
Light, Horse and Mountain Battery .....	.....	5†	.....	.....	.....	2	.....	.....	1	2	10

* Chiefs of 1st to 5th Section.

† Chiefs of 1st to 4th Section and Battery sergeant.

While the above quantities are based on a war footing the totals are necessary in peace for the training of the personnel of headquarters detachments and batteries.

Probability Table for Three-Inch Field Gun Based on the Firings at School of Fire for Field Artillery.

Range	The probable, or 50% zone ($2 \times$ probable error)						
	Due to variation of trajectory				Due to variation of fuze	Due to variation of trajectory and fuze	
	In range yards	Vertically yards	In deflection			In height of burst	
			Yards	Mils	In range yards	Yards	Mils
1500	70	3.2	4.7	3.1	70	4.5	3.0
1600	68	3.4	5.0	3.1	69	4.9	3.1
1700	67	3.7	5.3	3.1	68	5.3	3.1
1800	66	4.0	5.6	3.1	67	5.7	3.2
1900	65	4.3	6.0	3.2	66	6.1	3.2
2000	64	4.6	6.4	3.2	65	6.5	3.3
2100	64	4.9	6.8	3.2	65	7.0	3.3
2200	63	5.2	7.2	3.3	64	7.5	3.4
2300	63	5.6	7.6	3.3	64	8.0	3.5
2400	63	6.0	8.0	3.3	64	8.5	3.5
2500	63	6.4	8.4	3.4	63	9.1	3.6
2600	63	6.8	8.8	3.4	63	9.7	3.7
2700	63	7.2	9.2	3.4	63	10.3	3.8
2800	63	7.6	9.6	3.5	63	10.9	3.9
2900	63	8.1	10.0	3.5	63	11.5	4.0
3000	64	8.6	10.6	3.6	63	12.1	4.1
3100	64	9.1	11.1	3.6	63	12.7	4.2
3200	64	9.6	11.6	3.7	63	13.4	4.3
3300	65	10.2	12.1	3.7	63	14.1	4.4
3400	65	10.8	12.6	3.8	64	14.9	4.5
3500	66	11.4	13.2	3.8	64	15.8	4.6
3600	66	12.0	13.8	3.9	64	16.7	4.7
3700	67	12.7	14.5	4.0	64	17.6	4.9
3800	68	13.4	15.2	4.1	65	18.5	5.0
3900	69	14.2	16.0	4.2	66	19.6	5.1
4000	71	15.0	16.8	4.3	67	20.7	5.3

The above values approximate as closely as is permitted by the data at present available what may be expected in the firing of an entire battery, under average conditions of weather, matériel, and personnel, and for a period of time equal to that ordinarily required to attack one objective.

The vertical and range values of the trajectory are based on the analysis of one thousand nine hundred and twenty-six rounds of shrapnel, common and high explosive, fired in one hundred and eighty-two problems.

The deflection values are based on one thousand two hundred and five rounds of both shrapnel and shell, fired in one hundred problems.

The fuze values are based on seven hundred and forty-four rounds of common shrapnel, fired in eighty-five problems.

All values, particularly those of the fuze, are subject to change in the light of future data.

EDITORIAL DEPARTMENT

It has heretofore been deemed expedient to restrict the matter appearing in the FIELD ARTILLERY JOURNAL to articles and translations dealing exclusively with professional subjects, and to refrain from taking any stand editorially upon the many technical, legislative and administrative questions which from time to time become prominent, and which vitally concern the development, prestige and efficiency of our arm of the service. This course has resulted in the publication of a technical magazine, well worthy of being read and studied, but it has not made the FIELD ARTILLERY JOURNAL a medium through which field artillery views could be expressed, field artillery opinions ascertained or a field artillery policy formulated and emphasized. Our publication has been a record of field artillery thought, but it has not been a force capable of being wielded for the best interests of the arm.

At a recent meeting of the Executive Council it was decided to incorporate in the FIELD ARTILLERY JOURNAL an editorial department to be devoted to the discussion of matters of technique and policy, and to the formulation and expression of the opinion of the field artillery whenever that opinion can be ascertained. It is not the intention to make these editorials an expression of the views of the executive council nor of any one group of officers, but, through the cooperation of the members of the association, it is hoped to make them represent so far as possible the views of a majority of the officers of the field artillery. Such cooperation has been requested in letters recently sent to regimental and other commanders in the regular army and organized militia. If this cooperation is not received the editorial department can be nothing but a failure. With the desired assistance there is every reason to hope that it may play no unimportant part in the development of the field artillery.

The sporadic attempts which have been made in the past to ascertain the opinion of the field artillery upon important subjects have not met with much success. In this request we are behind the other arms of the service which are so well organized that their journals are at all times in a position to speak with confidence editorially of the attitude of their arms as a whole. Unquestionably the infantry and the cavalry use their journals as a medium of expression to a far greater extent than has ever been the case of the

Field Artillery. We are not willing to admit that officers of Field Artillery are less interested in their arm than are officers of infantry and cavalry, and we are confident that a sustained effort on the part of the various commanding officers concerned will make it possible for the FIELD ARTILLERY JOURNAL at all times to ascertain and utilize the expressed opinion of the Field Artillery upon any important subject.

It is impossible to provide for adequate national defense without considering the strength and organization of Field Artillery. During the consideration of the increase in Field Artillery which is believed by many to be inevitable, it will be necessary to be able to speak definitely in regard to the views of the Field Artillery on the desired strength and organization of our arm, its relation to the other arms in the matter of promotion, and the development of heavy field and siege units in the Coast Artillery. Lack of the necessary data with which to prepare a representative expression of opinion at the proper time may work irretrievable harm to the best interests of the Field Artillery, of the service at large and of the nation itself.

There is no intention of making the FIELD ARTILLERY JOURNAL a partisan publication or of committing it to the support of any policy which is based upon promotion or upon selfishness. Military efficiency can come only through the cooperation of all arms of the service; but there are times when an insistence upon a logical assignment of tasks to men trained for their execution becomes a patriotic duty; and it is not believed that the majority of Field Artillery officers are willing to have their journal unprepared or unwilling to place the association on record in favor of legislation, organization and methods which will give the arm its true rôle and provide the personnel and matériel necessary to carry it out.

CHANGES IN LIGHT AND HORSE ARTILLERY DRILL REGULATIONS.

Extensive changes in the Field Artillery Drill Regulations, 1911, Horse and Light (Provisional), have been prepared by the Field Artillery Board, and after certain modifications, have been approved by the War Department and will be issued to the service by the first of the year 1915.

Although the changes contain little with which officers who have kept pace with the technical development of Field Artillery in this

country are not already familiar and are already employing either consciously or unconsciously, their approval and publication should be considered as likely to have a most far-reaching and beneficial effect, and should be productive of that harmony which is so essential to progress and to the stimulation of that initiative without which no arm of the service can prosper. The changes are positive, not negative; they are not a limitation but rather may be considered an inspiration to every officer of Field Artillery to forget the insistence upon minor differences of opinion which has so hampered our development in recent years and to throw himself in a wholehearted manner into the task of making his battery, his battalion or his regiment ready for the test which may at any time be demanded of it.

It would be idle to ignore the fact that the present changes in drill regulations have been made necessary partially by the teachings of the School of Fire for Field Artillery and partially by the attitude of the War Department which insisted upon a stricter adherence to the word of the drill regulations than was apparently ever contemplated by the officers who prepared them.

When a school of fire was established, a comparatively liberal supply of ammunition provided, and officers of all grades required to conduct fire at the school it was inevitable that much would be learned in a practical way which was not generally known before, that officers who had never before given the subject of the conduct of fire a serious thought would begin to discuss it, and that those officers who had previously given the subject much thought but from a different point of view and under different conditions would differ in many respects from the officers responsible for the teachings of the school. Unfortunately, like all new ventures, the School of Fire had first to find itself, and at the same time to suffer as much from the often misrepresenting enthusiasm of its supporters as from the opposition of men who consciously believed its teachings to be incorrect.

One of the most often repeated criticisms was to the effect that the teachings of the school violated the drill regulations. From the point of view of those who believe that drill regulations should be considered hard and fast rules, this was undoubtedly correct; but to those who looked upon drill regulations as a book of instructions and a guide and not as a law it seemed that the School of Fire was simply progressing and keeping pace with the knowledge which was inevitably to be gained from constant thought, free discussion and

an expenditure of ammunition, which, although actually much too small, was far greater than that which had been available for any but a very limited number of our officers. It is believed that the officers who prepared the present Field Artillery Drill Regulations realized fully that progress can come only from opportunity combined with study and that drill regulations should be but a guide. Otherwise they never would have set forth this idea as ably and unmistakably as it is expressed in Paragraph 4, Field Artillery Drill Regulations, 1911:

"These regulations prescribe a method of training in the ordinary duties pertaining to the service of Field Artillery. The personnel must be so thoroughly drilled that in the excitement of action the duties will be performed as a matter of second nature.

"The regulations also outline general principles according to which Field Artillery is to be handled and fought. A guide is thus furnished as to the best way of dealing with the usual problems which arise. But every problem which arises in service has its own best solution, and this solution must be solved by the officer on the spot. His success will depend upon the extent to which he has prepared himself by previous thought and study and by previous practice in the solution of similar problems."

With reference to the detailed drill of the gun detachments, the same idea is well expressed in Paragraph 238 of the same regulations:

"It is most important that the gun squad should be drilled persistently and under all possible conditions in their combined duties in the service of the piece, the elements of which are set forth in the two preceding paragraphs. The several duties to be performed are there outlined; the readiest and most effective way of combining them, so as to insure mutual cooperation, is attained by practice and experience."

In spite of considerable opposition, the ideas of the School of Fire, sometimes correctly expressed and sometimes partially but unintentionally altered, began to make themselves felt throughout the several regiments, noticeably the Second Battalion, Third Field Artillery. During the summer of 1913, at Tobyhanna, considerable target practice was conducted under the supervision of Maj. Charles P. Summerall, Third Field Artillery, who not only incorporated many of the School of Fire methods but also inaugurated several other methods which indicate a desire to keep pace with the progress of the arm. The present changes in the drill regulations are the result of the discussion which followed the summer of

1913 at Tobyhanna and of the correspondence between the War Department and the School of Fire relative to the observance of drill regulations.

Although the Field Artillery Board believed that changes in drill regulations were not as desirable as a revision of the entire book, in following out their instructions the board confined itself almost entirely to the subjects which had been made prominent in the discussions referred to, and, for the sake of simplicity and brevity, left unchanged many paragraphs concerning information and communication service and artillery in the field which will eventually have to be changed. There are officers who believe that it would have been preferable to revise all the portions of the book that pertain to drill, making their provisions elastic but as permanent as possible, and then to issue a separate and complete pamphlet of "Firing Instructions" to be revised whenever the development of the arm demanded it, each revision to supersede entirely the previous one. Every one will agree that nothing is so confusing and annoying as a paragraph in drill regulations which has been changed one or more times.

In the discussion of the principles involved in the changes now under consideration it was found that much of the haze of misunderstanding which had sprung up between men of apparently different views disappeared when the several view-points were clearly seen and frankly presented; and it is not too much to say that the fact that we are all striving for the same goal was brought forth again and again, and that the result of the discussions which appears in the present changes is such that they will not only enable each officer to apply correct principles in the way that seems to him best fitted for the task at hand but will convince any fair-minded reader that at last we have a common ground for mutual effort and helpfulness.

The changes naturally group themselves into those pertaining to the functions and responsibilities of certain of the personnel, those which concern the details of actual drill, and those which involve principles governing the preparation and conduct of fire.

With reference to the responsibility for the conduct of fire, there is no change in the wording of the drill regulations of 1911. The present changes retain the wording which prescribes that the captain, as a rule, conducts the fire; but, by means of appropriate cross-references, directs attention to circumstances which may make it

necessary for higher commanders to assume the conduct of the fire of a portion of their commands, and also to the fact that under certain conditions it will be necessary to assign separate targets to chiefs of sections and chiefs of platoons who will then conduct the fire of their units under the direction of the captain. Emphasis is placed on the principle that, if possible, suitable tactical dispositions should be made to avoid the necessity of having higher commanders take from their captains the duty of conducting fire. The employment of cross-references in many of the changes is of great assistance to the student of the drill regulations; and it is to be regretted that they were not used in the regulations at first published.

By means of several changes running throughout the regulations the question of seniority amongst various officers and noncommissioned officers has been done away with. Lieutenants are assigned to the command of gun platoons, to the command of the combat train and to duty as reconnaissance officer, not according to rank, but according to the judgment of the captain based upon his knowledge of their ability, limitations and peculiar fitness for the varying duties involved. In a similar manner, corporals are assigned to duty as gunners in their sections regardless of rank. This provision is unquestionably a step forward and is based upon a correct principle. In assignments to artillery duties it is impossible to fit round pegs into square holes.

The increased authority and responsibility of the executive officer is recognized; and his duties are laid down in a clear and concise manner. He is very properly charged with the command of the battery whenever the captain is too far away to control it by word of mouth, and is at all times charged with the supervision of fire discipline. We have at last recognized the fact that an officer who is responsible for the conduct of fire must not be distracted by the details connected with the occupation of position and the service of the pieces. The executive officer is also made responsible that the sheaf is formed as soon as sufficient data have been received. This provision gives him ample authority to change or improvise aiming points, calculate a deflection difference which will produce parallel fire, employ reciprocal laying or resort to any appropriate expedient which will enable him to cooperate with the battery commander.

The exact responsibility of chiefs of platoons in regard to distribution is defined. Formerly there was much confusion as to what was meant by the "minor" changes which they had authority to

make in the deflection of their pieces in direct laying. The misleading word "minor" has been omitted, and the responsibility and authority of chiefs of platoon is clearly stated. In indirect laying confusion has similarly been avoided by providing that, if the target is visible to the chiefs of platoon, they will adjust the distribution only when so directed by the specific command, *Distribute the fire*. Simultaneous or cumulative changes by both the captain and the chiefs of platoon are thus avoided.

The reconnaissance officer is no longer made responsible for the determination of the firing data. He supervises the work of the fifth section and makes provision for the service of information and communication. It is manifestly impossible to lay down fixed duties for an officer detailed for this position.

An important addition to the duties of the commander of the combat train is involved in the position that he must establish communication with both the battery and the ammunition column and that he provide for the security of his train.

The first sergeant has not been so fortunate in having appropriate duties assigned to him. He still assists the captain, posts the limbers, attends to the replenishment of ammunition and the replacement of casualties, and, in addition, establishes communication and provides for the security of the limbers. Just how he is to perform this important duty while assisting the captain is not explained. Neither is it explained how he can supervise the replenishment of ammunition while he is assisting the captain who may be four hundred yards away from the battery. The entire mobility of the battery is in the limbers; and yet responsibility for their security is placed upon the shoulders of a noncommissioned officer who is required to be in three places at once. It was the desire of the Field Artillery Board that the importance of commanding the limbers and providing for their security be entrusted to the first sergeant and that he be relieved of his other conflicting duties. It is to be hoped that the common sense of captains and the resourcefulness of first sergeants will be sufficient to adjust the matter in spite of regulations.

Sergeants are no longer required to watch carefully the setting of sights, quadrants and fuse setters. A strict interpretation of this duty has in the past delayed the service of the piece; and it is believed that a liberal interpretation of the duty of supervising the service of their sections will produce much more satisfactory results.

The chief of the fifth section assists the captain in the determination of data.

The customary duties of the signal corporal and the battery scouts are enumerated, and all the corporals of the battery except the gunners are no longer grouped under the loose designation of "caisson corporals." As for the remaining corporals who are actually available for this duty, in the enumeration of their duties, the importance of communication between the elements of the subdivided battery is referred to.

All the caisson corporals of a battery are now trained as scouts and two of them are detailed to act as such. This is merely an extension of the former requirement that two caisson corporals be trained as scouts.

The post of the chief mechanic is prescribed as being with the firing battery. Under normal conditions this is a logical position for him, but he will naturally be employed where he can do the most good and where tools for his use are available. It would have been as well to omit specific reference to his post.

Some minor changes have been made in the provisions relating to the replacement of casualties. Although the senior first lieutenant naturally falls heir to the command of the battery eventually when the captain is disabled, the current changes wisely provide that the senior at the battery commander's station replaces the captain temporarily. Similarly it is recognized that if a chief of section is disabled some time will elapse before a sergeant from the combat train could replace him, and, in this case the chief of platoon will pay particular attention to the section concerned. A very wise provision is the one providing that if a gunner is disabled, he will be replaced by the best instructed man available, rather than necessarily by a caisson corporal as previously prescribed.

Some of the more radical changes affecting the details of actual drill are concerned with the simplification of commands and avoidance of confusion by omitting all unnecessary repetition of commands. Every non-essential word has been omitted. In the command for the range, the word *range* has been omitted; in the command for angle of site, only the word *site* remains; the cumbrous command *right platoon the adjusting platoon, by platoon from the right* has become *right from the right*. The familiar words *all the guns, volley fire one round* will no longer be heard. They have been shortened to *battery, one round*. *Commence firing* is shortened

to the time-honored command, *fire*, but the captain is required to give this command only in case of the first salvo or volley of a series. In all other cases, the guns are fired at the command of the executive when they are ready. One of the most noticeable changes is involved in the substitution of the words, *open* and *close* for *increase* and *diminish* wherever they occur. This really involves more than a change in command, it passes the responsibility from the captain to the executive officer and the gunners; but as it unquestionably simplifies the manipulation of the sheaf for the captain, and as executive officers and gunners have successfully met various other increases in their responsibilities, it is believed that the service will soon become accustomed to the change. It has the great advantage of being unmistakable—when we wish to open the sheaf, we are now permitted to say *open* and are not required to search in our minds for the arbitrary term *increase*.

Probably no change in the commands has been more discussed or will cause more comment than the introduction of *four hundred more, two hundred less* and the like. This involves far more than a change in commands. It is a far-reaching change in the conduct of fire, implying not only another burden for the mind of the executive officer, but also a relaxing of that mental discipline on the part of the captain which by many is considered essential if he is to know just what he has done and what he can do next. Excellent results have been obtained with this method at target practice with well-trained batteries, and many officers with limited training have successfully conducted fire by its use who otherwise might possibly have to come to grief by the forgetting of a concrete range. It is but a logical development of the idea in *add* and *subtract* and *up* and *down*. It is believed that this change will be accepted by the service at large with a mingling of hope and fear—hope that one of the difficulties of conducting fire has been wisely removed, and fear that the captain has too completely passed on his responsibilities to his battery. It is to be noted that this method of announcing a range is optional only. Officers would do well to vary the method with the former one of announcing a concrete range on account of the memory training involved if for no other reason. The method has never been tried out in extensive fire for effect; and although this might also be said of every method of fire which we have, we probably know less about the ultimate effect of this method than of any other.

The changes in the duties of the different cannoneers during the service of the piece are already familiar to most of the regular batteries and to many of the militia batteries. An increased amount of target practice at moving targets has shown that No. 2 cannot load the piece and at the same time attend to the very important duty of handling the trail. The facility with which an expert No. 2 can assist his gunner by an accurate shift of the trail increases the rapidity of fire to a great extent. With fifty and one hundred mil divisions marked on the top and main shields for his assistance, and with a practical working knowledge of the value in mils of the width of different parts of the trail-spade, a good No. 2 is almost independent of the once familiar command, *trail right* or *trail left*. The objections which have been raised to the change are based on the fact that there is very little cover for No. 2 while at the end of the trail and that, in many engagements, frequent shifts of the trail will be unnecessary and that No. 2 will be idle much of the time. It is believed that, when a shift of the trail is necessary, someone will have to shift it, cover or no cover, and that when shifts are not expected, no competent chief of section will permit his No. 2 to remain either uncovered or idle. These are matters not for drill regulations but for team-work and discipline. The service of the piece while firing at moving targets is the most difficult of all conditions and gun detachments which can adapt themselves to difficult conditions will have no trouble in more favorable circumstances.

With No. 2 assigned to other duties, it becomes necessary for No. 4 to load the piece. Experience has shown that as soon as one round of shrapnel has been removed from the fuse setter, if another is at once inserted and given the former setting, it is a simple matter for No. 4 to complete the setting, if necessary, and load the piece. This has led to the present division of duties, wherein No. 3 keeps the fuse setter set at all times, No. 5 inserts a new round as soon as No. 4 has removed the previous one and gives it the old setting, and when No. 4 again reaches for a round he has but an almost instantaneous setting to make. Although it is to be hoped that a faster fuse setter may yet be designed, the method of setting fuses and handling ammunition now prescribed will increase the rapidity of the service of the piece greatly and do much to remove the objection to the present fuse setter.

In order to fit him for the increased responsibilities of his position,

provision is now made for training No. 2 by having him shift the trail at the command *add* or *subtract* so much.

The changes now give authority to load in percussion fire as soon as the piece has been fired. This increases the rapidity of fire and should cause no accidents in batteries in which there is sufficient fire-discipline to insure a piece being unloaded in case a shell is not fired.

Many officers have felt for some time that the requirement of the drill regulations which caused the gunner to set the sight for range in indirect laying was unnecessary. It burdened the man's mind with a detail not in the least connected with his duty of laying the piece in direction only and caused considerable delay. It was included in the drill regulations at a time when more mathematical accuracy was sought after than has since been found possible or essential. It was a requirement often impossible of compliance because high aiming points could be seen only by raising the sight shank. This caused confusion with inexperienced gunners, who were puzzled by two conflicting requirements. Practical tests convinced the Field Artillery Board that, under normal conditions, gunners who were unrestricted would naturally, through convenience, raise their sight shanks in an almost uniform manner, and that, when such was not the case, the error in deflection or distribution caused by having the several sights at varying heights was too small to have any practical effect. The matter was thoroughly discussed, with the result that the gunner is no longer required to set off the range, but must raise or lower his sight shank until the bubble of the elevation level is approximately centered. This will, it is believed, lead to confusion. Gunners will carry out these instructions independent of the elevation given by No. 1, who may afterwards derange the leveling, and the gunners will be liable to check and reprimand. It is believed that the gunner is in no more enviable position than he was when he was required to set off the range, and that he has now been required to do an unfamiliar thing which is no easier than the one previously required of him.

The requirement that empty cases be stored at once has been done away with. They are now allowed to drop on the ground and stored when convenient. A logical method of handling drill cartridges is prescribed by which No. 4 receives them, passes them to No. 5, who resets them at safety and replaces them in the chest.

The wording of the paragraph dealing with collar-fitting has been amended so as to bring out the principles involved in the former paragraph but which have been misunderstood. The *thickness* of the hand rather than its *width* is now referred to and the meaning is unmistakable and should lead to a snugger fit being insisted upon than has been customary in some batteries.

An error which was allowed to creep into the former paragraph governing the adjustment of traces has been corrected by prescribing that the line of traction shall be *normal* to the shoulders rather than *straight* from the single tree to the collars of the leaders.

Although it was recognized that extensive changes might have been made in chapters dealing with The Battery Mounted, Field Artillery Information Service and Artillery in the Field, it was considered that the changes were already extensive enough, and only in a few cases are such portions of the drill regulations changed. In the paragraph dealing with the definition of sight defilade, dismounted defilade, mounted defilade and flash defilade, the sentence is omitted which indicated that a battery commander will be required to take a given amount of defilade as thus defined. It was recognized that a battery commander will have to use his own judgment and comply with the instructions of his battalion commander in regard to defilade as well as circumstances will permit, but that only confusion will result if the drill regulations prescribe conditions which are sometimes impossible to fulfill.

The regulations have been made much more practical and more flexible by permitting carriages to be unlimbered from any formation in emergencies, and sections to be served when caissons are on the right as well as when they are on the left of their pieces. The former restriction which required the captain to have his caissons on the right before executing *action rear* and which subjected him to annoyance when this was not done was but a relic of the obsolete formal drill which has no bearing upon the practical employment of field artillery. The intervals between carriages after they are unlimbered are also made flexible and dependent upon conditions existing at the time.

The former requirement that carriages be aligned after unlimbering has been modified so as to provide that they be approximately aligned before unlimbering. This change comes from a recognition of the fact that, although correct alignment and intervals

are desirable, they are not essential, and that time and effort should not be taken to obtain alignment after unlimbering.

In describing the method of unlimbering, the duties of the connoneers who work on the wheels have not been given in detail, but only in general. It was recognized that, although men on a parade ground may always work on the wheels the same way, that men unlimbering a battery on heavy ground or on a side hill will have to suit their efforts to meet the existing conditions and that it is best not to restrict them. They are no longer required to lower the caisson prop, as it has been found that the ammunition can be handled as well when the trail is allowed to drop on the ground, and that there is no danger of a loaded caisson tipping over backward on a side hill. The historic command, so typical of the older battery drill, *drive on*, has been superseded by a signal. The provision is but another example of the attempt to make batteries as silent as possible.

The provision relating to the position of the limbers has been modified so as to prescribe twenty instead of ten yards as a usual interval between adjacent limbers and to give the first sergeant more latitude in the formation to be taken under different conditions. The former interval of ten yards was considered as making the limbers too vulnerable.

The present changes require that whenever the battery is prepared for action sights are set at zero deflection, range one thousand, and that the fuse setters are set at corrector thirty, range zero. This provision was inserted in order that batteries unlimbered suddenly in an emergency might be ready to deliver *fire at will* in the shortest possible time.

The necessary provisions for the care of sights and quadrants during short changes of position when the *march order* is not taken are included. It would have been well to have brought the entire subject of the sub-division and preparation for action up to date. In most batteries it is believed that these matters have been attended to according to a custom which is nearly identical in all regiments and which necessarily varies from the drill regulations which do not adequately provide for preparing for action and continuing the march.

Although it is stated that cases will arise in which the battery commander will have to leave his station after selecting it, meet his battery and conduct it personally to its position, it is believed

that such cases will generally be in the occupation of unmasked positions, and that, in the normal occupation of a masked position, it will be unnecessary for the captain to leave his station after having once selected it. Well instructed battery scouts and harmony and team-play between the captain and executive officer will insure an orderly occupation of position without the personal attention of the captain beyond the instructions given by him when the position is first selected.

Cannoneers are now required to go about their duties as soon as they hear the commands, and chiefs of platoon and section are required to repeat only those commands which have not been understood by the cannoneers. Like any other well-adjusted machine, a battery should operate as silently as it does accurately; and nothing was more conducive to confusion and error than the repetition of command formerly required. The chiefs of platoon and section are required to be ready at all times to detect errors and to supply any data which may be required by the cannoneers. It is easy to see that they are thus far better employed than when they were required to repeat in turn commands which their cannoneers had already heard. Some repetition was necessarily required in the days when collective distribution was so little understood by all concerned that there appeared to be something requiring the attention of a commissioned officer in the application of a deflection difference. We have since learned that gunners can apply changes in deflection and deflection differences quickly and accurately without the intervention of a chief of platoon.

The provision which requires all officers and enlisted men at the firing battery to report all errors as soon as they are discovered is a very important one and is essential to the prompt adjustment of fire. Nothing is more perplexing than a correction based upon the observation of a shot fired with incorrect data; and nothing is so truly indicative of good discipline as a willingness on the part of cannoneers to report errors which they have themselves made.

An explanation of the parallel method of calculating the deflection of the right piece is included for the benefit of those who are not already familiar with it. It should never be necessary to give authority for a solution of a problem of this kind in any way suited to the ability and facilities of the man who is to solve it; but in any future changes it would be well to bring the entire subject

of the calculation of firing data up to the standard of simplicity which now exists very generally throughout the service.

The examples of the application of fire previously included in Paragraph 418 were omitted because it was felt that they savored too much of fixed solutions and that they might be misleading. The examples are undoubtedly interesting and the result of much careful study, but their solutions of many problems were inconsistent with some of the provisions of the changes, and it was not considered desirable to revise them.

In discussing methods of fire and application of fire, every effort has been made to eliminate rules and to base the provisions of the drill regulations upon correct general principles with a view to permitting officers to use their best judgment under any given conditions.

The varying advantages of salvos and volleys and of the use of the battery or of a single platoon in fire for adjustment are well set forth, and with no partisan insistence upon either method. When it is desirable to identify the bursts, salvos are advised; when it is necessary for the gunner to control the instant of firing, volleys naturally are considered appropriate. The tactical situation, the conditions of observation, the presence or absence of a range finder and the previous knowledge of elements of the firing data all have an important bearing upon whether the battery or a single platoon should be employed. Unquestionably if the officer firing is competent to observe correctly and utilize in a logical manner all the information that there is to be gained from a battery salvo he would do well to use all four guns in preference to limiting himself to two, especially when he has any accurate information concerning the range; and his choice must in any case be made to fit the conditions of the day and his own knowledge of his ability and limitations. These considerations apply more to action rather than to target practice in which ammunition will never be plentiful.

Adjustment by use of a single piece is referred to as an exceptional method, but the advisability of using it under certain conditions is not discussed.

An important change is involved in the provision whereby the sheaf may be opened or closed on any desired piece. Although this also increases the responsibilities of officers and noncommissioned officers with the guns, it increases the flexibility of the sheaf to such an extent that the added degree of training necessary to

have it carried out correctly by the gunners will be more than compensated for. It permits the use of the left platoon in indirect laying without increasing the difficulty involved, since, after the first salvo, either the third or the fourth piece may be used as the directing piece by the command, for example, *on third piece, close by five*.

The importance of having the angle of site as nearly correct as possible is emphasized, and the necessity for adjusting the height of burst by a change in the angle of site under certain conditions is referred to. The influence of the introduction of an accurate range finder is briefly brought out. This is considered a most important point. It is obvious that, when an accurate range finder is being used, if adjustment with an incorrect angle of site is attempted, the benefit to be expected from the range finder will be neutralized and the adjustment delayed. As the Goerz range finder has already been authorized and has given excellent results at the School of Fire, its use throughout the service will inevitably bring out this and many other points which may eventually have a most radical effect upon our methods of fire. The fact that the corrector, when not normal, will vary with the range is stated, and a rule of thumb for the calculation of corrector under these conditions is given.

The desirability of having a large percentage of grazes during fire for effect is not confined, as in the previous wording of the regulation, to action against troops in the open, but is extended to all time-fire. This provision may possibly be considered as not entirely consistent with the retention of the one mil height of burst as the desirable height for adjustment.

The discussion of the various depths of brackets which it is desirable to obtain under ordinary conditions is very clearly stated, and brings out more clearly than did the previous regulations the fact that, in time fire, as close an adjustment as is implied by a one hundred-yard bracket can ordinarily be obtained only against artillery in position or against troops in trenches or otherwise immobilized, and that tactical and other considerations usually indicate the advisability of contenting oneself with a wider bracket against all targets moving or capable of mobility.

Attention is drawn to the necessity of attacking a rapidly moving target from a direction opposite to the movement of the target. An advancing target is ordinarily to be attacked by increments, a retiring target by decrements.

The entire question of the size of the bracket to attempt is stated with great clearness and conciseness in the following words:

Page 133. Substitute for paragraph 401 the following:

401. The minimum bracket possible of determination depends upon the accuracy of the gun. The establishment of a bracket narrower than the fifty per cent zone is difficult.

The bracket to be used depends upon the tactical situation and the conditions of observation.

The question of the range at which fire for effect should be opened after a bracketing salvo or effect on the target has been observed is well covered by the very broad statement that an "appropriate" range should be used and the adjustment of the other elements of the sheaf should be continued by bold changes.

The provisions relating to the observation and denomination of the height of burst and to the handling of the corrector will be very familiar to those who have attended the School of Fire. The terminology and methods have both become very general throughout the service, and it is well to have them included in the drill regulations. The true significance of a burst below the target and of impacts above the target are brought out.

The advisability of sensing each shot and discarding as "doubtful" all shots that do not furnish definite information are both emphasized and lead naturally to the omission of all reference to the verifying salvo as such. The spirit of the regulations as amended is understood to lay special stress upon accurate observation.

The firing of volleys for effect at a single range is referred to as being of extremely doubtful value for the reason that it will seldom be possible to expend time and ammunition enough to obtain adjustment close enough to warrant such a method. This provision also has a bearing on the omission of the verifying salvo. All fire is to be considered as fire for adjustment, and the sharp distinction between fire for adjustment and fire for effect is no longer made. The general principle involved seems to be the establishment of an approximate adjustment with as little delay as possible and the refinement of this adjustment obtained during the delivery of fire for effect.

The methods advised for attacking the target once the preliminary bracket has been determined will naturally arouse more interest than any other of the changes published at this time, for about

them cluster nearly all the differences of opinion which once seemed so important and which it is believed will now disappear in the harmony and progress made possible by the liberal spirit of the changes under consideration. It is perhaps advisable to quote directly in order to avoid misunderstanding:

Page 121. Substitute for paragraph 353 the following:

353. In time-fire, the short and long limits of the bracket determined during the initial adjustment should be considered as inclosing an area to be covered during fire for effect at successive ranges. This can be accomplished either by opening fire for effect at a short range and using successive increments, or at a long range and using successive decrements until a range short of the target is obtained. Thus the target will be covered at one or more of the ranges used, and the officer conducting the fire may be able to form an opinion as to which are the most effective ranges.

If he is not convinced that the short limit of the bracket corresponds to a short range, the captain, in covering the area inclosed by the limits of the bracket, should insure himself against overshooting by opening fire for effect at a range short of the short limit.

Every target attacked will present its own problem, which must be solved according to existing conditions and not by adherence to any fixed rule.

It is hard to see how any more liberal or elastic statement of a principle could be made. The method to be used depends not upon a rule but upon the mission, the means and the man.

The reference to the inadvisability of basing minor changes upon the observation of one shot is not understood as opposed to the principle that conditions of observation often make it necessary to base large changes during initial adjustment upon the observation of one shot. As a matter of fact, we have all seen firing under conditions of observation so difficult that a captain who could obtain a reliable observation of one shot was considered fortunate in the extreme. The provision in question is rather understood as opposed to attempting refinements in adjustment without sufficient information upon which to base them.

Although in theoretical discussions many so-called rules of fire are based upon the assumption that a sensing may be obtained only at the instant of burst, practice shows us that much information may be obtained from fragments, shrapnel balls, fuses, dust, shadow and smoke. These factors were previously carefully considered

in the drill regulations, but the present changes wisely bring out a distinction between the observation of effect beyond the target which is always indicative of a long range, and effect observed short of the target which is truly indicative of a short range only when the burst is low. In this connection the action of high-explosive shrapnel, with its advantages and disadvantages, are described.

No attempt has been made to follow in detail every change. Such a consideration of an extensive and necessarily involved revision of drill regulations would be as long as the changes themselves, and would be of little value. The student of the changes will find many points of interest which are here not touched upon or overlooked, but it is hoped that this résumé of the changes and brief comment on some of their underlying principles will serve not only to explain them, but to indicate to what an extent they may be used as a medium for greater future harmony and cooperation if they are but received in the same spirit in which they have been prepared.

MAJ. WILLIAM J. SNOW.

The retirement of Maj. William J. Snow, Second Field Artillery, from the Executive Council and from the office of Treasurer of the Field Artillery Association, which has been made necessary by his departure from the United States, is a fitting opportunity to refer to the ability, untiring industry and high-minded loyalty with which he has served the Field Artillery Association and labored for the *FIELD ARTILLERY JOURNAL*.

Both the Field Artillery Association and the *FIELD ARTILLERY JOURNAL* owe much to his far-sightedness, his powers of organization and his winning personality through which, after innumerable discouragements, he at last won the support of the majority of the field artillery officers of the regular army and the organized militia.

For a long time he carried almost entirely upon his own shoulders the many details connected with the management of the affairs of the Field Artillery Association and the publication of the *FIELD ARTILLERY JOURNAL*, and even after the actual editing of the *FIELD ARTILLERY JOURNAL* had passed to others, he never ceased to advise, to labor and to encourage those who had the actual work in hand.

He first recognized that the field artillery of the regular army, pitifully inadequate in itself, could be increased in value as a national asset by the development of the field artillery of the organized militia. For this reason he strongly advocated extending to militia officers full membership in the Field Artillery Association and representation on the Executive Council. This not only strengthened the Field Artillery Association, but also set an example to the associations representing other arms. He also labored untiringly to obtain for the field artillery of the organized militia increased strength, proper organization, adequate equipment and exceptional opportunities for instruction.

Although these facts are well known to every officer in the army and the organized militia who has followed the development of field artillery in recent years, this public recognition of the debt which the Field Artillery Association owes to Major Snow is deemed appropriate and timely.

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TO CURRENT FIELD ARTILLERY LITERATURE.

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Field Artillery Directory

REGULAR ARMY

Name.	Batteries.	Name.	Batteries.
FIRST FIELD ARTILLERY. (Light.)		<i>Second Lieutenant—Continued</i>	
Schofield Barracks, H. T.		Andrews, Joseph.....	D
<i>Colonel.</i>		Deshon, Percy.....	F
		Maxwell, Russell L.....	E
		Winton, Walter F.....	B
		Daly, Joseph O.....	C
Sturgis, Samuel D.....		<i>Veterinarians.</i>	
<i>Lieutenant Colonel.</i>		Willyoung, Lester E.....	
McMahon, John E.....		Donovan, Andrew E.....	
<i>Majors.</i>		SECOND FIELD ARTILLERY. (Mountain.)	
Cruikshank, William M.....	2 Batt.	Philippine Islands.	
Guignard, William S.....	1 Batt.	<i>Colonel.</i>	
<i>Chaplain.</i>		Millar, Edward A.....	
Fealy, Ignatius (1 lieu.).....		<i>Lieutenant Colonel.</i>	
<i>Captain.</i>		Irwin, George Le R.....	
Cassels, Arthur F.....	Adjt.	<i>Majors.</i>	
Hopkins, Frank E.....	D	Horn, Tiemann N.....	2 Batt.
Williams, Harry C.....	E	Payne, Brooke.....	1 Batt.
Apple, George M.....	Comy.	<i>Chaplain.</i>	
Deems, Clarence, Jr.....	F	Houlihan, James F. (1 lieu.).....	
Bunker, Charles M.....	B	<i>Captains.</i>	
Mason, Roger O.....	C	Granger, Ralph S.....	F
Browning, William S.....	Adjt.	Stuart, Edward A.....	Unass'd
	1 Batt.	Birnie, Upton, Jr.....	E
Ennis, William P.....	A	Warfield, Augustus B.....	D
Frankenberger, Samuel.....	Unass'd	Barnes, Joseph F.....	Unass'd
Rehkof, Ned B.....	Adjt.	Browne, Beverly F.....	Unass'd
	2 Batt.	Hollyday, Thomas W.....	Adjt.
Glassford, Pelham D.....	Unass'd		2 Batt.
<i>First Lieutenant.</i>		Mortimer, Charles G.....	A
Neal, Carroll W.....	E	Allen, Charles M.....	Qm.
McKinlay, Louis H.....	A	Morrison, William F.....	Adjt.
Dodds, William H., Jr.....	C	Allin, George R.....	1 Batt.
Huntley, Harold W.....	C		B
Lyerly, Ballard.....	D	<i>First Lieutenants.</i>	
Potter, Waldo C.....	A	Blakely, Charles S.....	A
Pfeil, Harry.....	Unass'd	Cubbison, Donald C.....	B
Naylor, Harold S.....	F	Riley, James W.....	C
Marr, Harold E.....	B	Parker, Cortlandt.....	E
Martin, Truby C.....	Qm. and comy.	Lewis, Robert H.....	F
	2 Batt.	Booker, Philip W.....	F
Rogers, Wilbur.....	F	Pritchett, Edwin E.....	D
Palmer, Albert K. C.....	D	Rucker, William H.....	E
<i>Second Lieutenant.</i>		Shepherd, William H.....	B
Gay, George S.....	Qm. and comy.	Dunn, William E.....	A
	1 Batt.	Gottschalk, Telesphor G.....	C
Selleck, Clyde A.....	C	Rumbough, Joseph W.....	D
Beard, Louie A.....	B	Brabson, Joe R.....	Qm. and comy.
Jones, Ivens.....	A		
Goetz, Robert C. F.....	D		
Peyton, Bernard R.....	F		
Bowley, Freeman W.....	E		

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.	Name.	Batteries.
<i>Second Lieutenants.</i>		<i>Second Lieutenants.</i>	
Seaman, George G.....	2 Batt. Qm. and comy. 1 Batt.	Greble, Edwin St. J., Jr.....	Unass'd
Dawley, Ernest J.....	E	Bateman, Harold H.....	A
Magruder, John.....	C	Wallace, Fred C.....	E
Riggs, E. Francis.....	D	Odell, Herbert R.....	B
Nance, Curtis H.....	A	Simpson, Bethel W.....	F
Beatty, John C.....	E	Vanderveer, Harold C.....	E
Proctor, Mert.....	B	Browne, Charles J.....	B
Meyer, Vincent.....	C	Parker, Edwin P., Jr.....	D
Wilson, Robert W.....	A	Eager, John M.....	F
Barnes, Julian F.....	F	Brewer, Carlos.....	A
Gillespie, James A.....	D	Cain, David E.....	C
Clarkson, Herbert S.....	B	McMahon, John E., Jr.....	C
Helmick, Charles G.....	F	Thurber, Philip L.....	D
<i>Veterinarians.</i>		<i>Veterinarians.</i>	
Mitchell, Aquita.....		Griffin, Gerald E.....	
Seeley, Burton A.....		Gage, Fred B.....	
THIRD FIELD ARTILLERY. (Light.)		FOURTH FIELD ARTILLERY. (Mountain.)	
Hdqs. and Battys, A. B. and C, Ft. Sam Houston, Tex. Battys, D, E, and F, Ft. Myer, Va.		Texas City, Tex.	
<i>Colonel.</i>		<i>Colonel.</i>	
Van Deusen, George W.....		Berry, Lucien G.....	
<i>Lieutenant Colonel.</i>		<i>Lieutenant Colonel.</i>	
Menoher, Charles T.....		Lassiter, William.....	
<i>Majors.</i>		<i>Majors.</i>	
Snow, William J.....	2 Batt.	Gately, George G.....	2 Batt.
McCloskey, Manus.....	1 Batt.	McMaster, Richard H.....	1 Batt.
<i>Chaplain.</i>		<i>Chaplain.</i>	
Perry, Barton W. (maj.).....		Joyce, Francis P. (capt.).....	
<i>Captains.</i>		<i>Captains.</i>	
Stephens, John E.....	A	Merrill, Thomas E.....	E
Gallup, Fred H.....	Adjt. 2 Batt.	Newbold, Henry L.....	Adjt. 1 Batt.
Farrar, Henry B.....	Unass'd	Spaulding, Oliver L., Jr.....	F
Austin, Fred T.....	Adjt.	Lansing, Cleveland C.....	B
Donnelly, Edward T.....	F	Langdon, Jesse G.....	C
Jones, Clarence N.....	D	Craig, Daniel F.....	A
Hennessy, Frederick B.....	B	Burt, William H.....	Adjt. 2 Batt.
Locke, Morris E.....	D	Lawson, Laurin L.....	Adjt.
Michel, William N.....	C	Brewster, Alden F.....	Comy.
Myers, Joseph E.....	Qm.	Kilbourne, Henry S., Jr.....	Qm.
Ferris, Charles J.....	Adjt. 1 Batt.	McNair, Lesley J.....	Unass'd
<i>First Lieutenants.</i>		<i>First Lieutenants.</i>	
Honeycutt, Francis W.....	D	Quinn, Leo P.....	E
Hammond, John S.....	B	Prosser, Walter E.....	A
Carter, Arthur H.....	E	Collins, Leroy P.....	F
Smith, Edwin De L.....	B	Harlow, Charles W.....	B
Burleson, Richard C.....	D	Greely, John N.....	A
Olmstead, Dawson.....	F	Mort, John E.....	C
Paine, George H.....	E	Barrows, Frederick M.....	D
Downer, John W.....	Unass'd	Burns, James H.....	C
Parrott, Roger S.....	A	McCleave, William.....	D
Kirkwood, Robert G.....	Unass'd	McBride, Allan C.....	Qm. and comy. 1 Batt.
Dougherty, Louis G.....	A	Sparks, Leonard C.....	Qm. and comy. 2 Batt.
Hopkins, Samuel R.....	Qm. comy. 2 Batt.	Hollingsworth, Charles P.....	E
Daly, Charles D.....	C	Stewart, Frederick W.....	B

FIELD ARTILLERY DIRECTORY—Continued

Name.	Batteries.	Name.	Batteries.
<i>Second Lieutenants.</i>		<i>Second Lieutenants</i>	
Taliaferro, Lucien H.....	F	Crane, William C., Jr.	E
Turner, Frank A.	B	Sedlacek, Ernest	F
Finch, Neil G.	C	Houghton, William C.	C
Erwin, Vincent P.	Unass'd	Anderson, John B. (addl.)	A
Hicks, Edward H.	D	<i>Veterinarians.</i>	
Anderson, Jonathan W.	B	Hill, William P.	
Bailey, Wesley M.	A	Stokes, Wilfred J.	
von Holtzendorff, John D.	D		
Austin, Raymond B.	E		

LINEAL RANK

No.	Name, rank, and date of rank.	Reg't.	No.	Name, rank, and date of rank.	Reg't.
<i>Colonels.</i>			<i>Captains.</i>		
1	a Adams, G. 11 mar. 11	5	14	Farrar, H. B. 27 sept.	3
2	Greble, E. St. J. 11 mar.	6	15	Granger, R. S. 2 feb. 05	2
3	Treat, C. G. 6 may,	16	16	Moore, D. T. 14 apr.	5
4	Van Deusen, G. W. 7 sept.	3	17	Hopkins, F. E. 24 feb. 06	1
5	Millar, E. A. 1 dec.	2	18	Austin, F. T. 14 apr.	3
6	Sturgis, S. D. 27 dec. 12	1	19	Pulis, C. C. 9 june,	
7	Berry, L. G. 16 mar. 13	4	20	Boiseau, I. T. 25 jan. 07	6
<i>Lieutenant Colonels.</i>			<i>Captains.</i>		
1	McMahon, J. E. 3 may, 11	1	24	Brooke, G. M. 25 jan.	
2	Menoher, C. T. 26 may,	3	25	Williams, H. C. 25 jan.	1
3	Hinds, E. 1 dec.	26	26	Faulkner, A. U. 25 jan.	
4	March, P. C. 8 feb. 12	27	27	Lansing, C. C. 25 jan.	4
5	Kenly, W. L. 26 aug.	6	28	Apple, G. M. 25 jan.	1
6	McGlachlin, E. F., jr. 27 dec.	5	29	Yule, E. H. 25 jan.	
7	Lassiter, W. 16 mar. 13	4	30	Westervelt, W. I. 25 jan.	
8	Irwin, G. Le R. 18 nov. 14	2	31	Birnie, U., jr. 25 jan.	2
<i>Majors.</i>			<i>Captains.</i>		
1	McNair, W. S. 15 nov.	35	32	Deems, C., jr. 25 jan.	1
2	Snow, W. J. 3 mar. 11	3	33	Doyle, F. C. 25 jan.	6
3	Gatley, G. G. 11 mar.	4	34	Jones, C. N. 25 feb. 08	3
4	Lyon, Le R. S. 11 mar.	38	35	McIntyre, E. C. 25 jan. 07	
5	Horn, T. N. 11 mar.	2	36	Greene, G. R. 25 jan.	5
6	Summerall, C. P. 11 mar.	40	37	Briggs, R. W. 25 jan.	2
7	Cruikshank, W. M. 11 mar.	1	38	Bunker, C. M. 25 jan.	1
8	Farr, O. W. B. 13 apr.	42	39	Griffin, F. W. 25 jan.	
9	Aultman, D. E. 3 may.	6	40	Welsh, R. S. 25 jan.	6
10	Fleming, A. S. 26 may.	44	41	Campbell, T. 25 jan.	6
11	Payne, B. 7 sept.	2	42	Langdon, J. G. 25 jan.	4
12	Guignard, W. S. 1 dec.	1	43	Craig, D. F. 25 jan.	4
13	Bowley, A. J. 9 feb. 12	5	44	Warfield, A. B. 25 jan.	2
14	Bishop, H. G. 26 aug.	5	45	Burt, W. H. 12 june.	4
15	Newbill, W. D. 27 dec.	49	46	Hennessy, F. B. 26 july,	3
16	McCloskey, M. 16 mar. 13	3	47	Lawson, L. L. 12 aug.	4
17	McMaster, R. H. 18 nov. 14	4	48	Locke, M. E. 25 aug. 08	3
<i>Captains.</i>			<i>Captains.</i>		
1	Stephens, J. E. 23 sept.	3	49	Kilbreth, J. W., jr. 1 apr. 04	6
2	Merrill, T. E. 23 sept.	4	50	Bryson, J. H. 10 sept. 09	
3	Conner, F. 23 sept.	5	51	Mason, R. O. 30 sept.	1
4	Butner, H. W. 23 sept.	6	52	Browning, W. S. 15 nov. 10	1
5	Newbold, H. L. 23 sept.	4	53	Barnes, J. F. 3 mar. 11	2
6	Scott, E. D. 23 sept.	6	54	Ennis, W. P. 11 mar.	1
7	Smith, W. 20 sept. 02	5	55	Currie, D. H. 11 mar.	
8	Starbird, A. A. 31 july, 03	5	56	Browne, B. F. 11 mar.	2
9	Lloyd, C. R. 14 aug.	6	57	Pratt, R. S. 11 mar.	
10	Spaulding, O. L., jr. 27 aug. 03	4	58	Brewster, A. F. 11 mar.	4
11	Lanza, C. H. 1 nov.	5	59	DeArmond, E. H. 11 mar.	5
12	Cassels, A. F. 23 nov.	1	60	Wood, N. E. 11 mar. 11	5
13	Gallup, F. H. 7 july, 04	3	61	Fuger, A. S. 11 mar.	
			62	Michel, W. N. 11 mar.	3
			63	Wheeler, E. S. 11 mar.	
			64	Hollyday, T. W. 11 mar.	2
			65	Corey, J. B. W. 13 apr.	
			66	Churchill, M. 13 apr.	
			67	Jones, W. F. 13 apr.	

FIELD ARTILLERY DIRECTORY

FIELD ARTILLERY DIRECTORY—Continued.

No.	Name, rank, and date of rank.	Reg't.	No.	Name, rank, and date of rank.	Reg't.
<i>Captains</i>			<i>First Lieutenants.</i>		
68	Mortimer, C. G. 26 may.	2	56	Greely, J. N. 11 mar.	4
69	Margetts, N. E. 26 may.	6	57	Capron, W. A. 11 mar.	5
70	Davis, R. 7 june.	58	58	Mort, J. E. 11 mar.	4
71	Myers, J. E. 7 sept.	3	59	Barrows, F. M. 11 mar.	4
72	Wood, W. S. 8 sept.	60	60	Dunn, W. E. 11 mar.	2
73	Frankenberger, S. 18 oct.	1	61	Burns, J. H. 11 mar.	4
74	Allen, C. M. 1 dec.	2	62	Hughes, E. S. 11 mar.	.....
75	Morrison, W. F. 9 feb. 12	2	63	Smith, T. J. 11 mar.	.....
76	Ferris, C. J. 26 aug.	3	64	Parrott, R. S. 11 mar.	3
77	Rehkopf, N. B. 11 july, 13	1	65	Gottschalk, T. G. 11 mar.	2
78	Baker, S. 9 oct.	66	66	Higley, H. D. 11 mar.	6
79	Howze, M. W. 24 oct.	67	67	King, E. P., jr. 13 apr.	6
80	Kilbourne, H. S., jr. 22 nov.	4	68	Perkins, K. S. 13 apr.	5
81	McNair, L. J. 19 apr. 14	4	69	Kirkwood, R. G. 13 apr.	3
82	Allin, G. R. 13 june.	2	70	Marr, H. E. 26 may.	1
83	Hand, D. W. 25 jan. 07	5	71	Rumbough, J. W. 7 june.	2
84	Glassford, P. D. 18 nov. 14	1	72	McCleave, W. 13 june.	4
<i>First Lieutenants.</i>			73	McBride, A. C. 20 june.	4
1	Bryden, W. 25 jan.	5	74	Brabson, J. R. 20 june, 11	2
2	Honeycutt, F. W. 25 jan.	3	75	Sparks, L. C. 1 july.	4
3	Blakely, C. S. 25 jan.	2	76	Crane, J. A. 1 july.	5
4	Smith, E. T. 25 jan.	5	77	Prince, F. A. 1 apr. 12	5
5	Danford, R. M. 25 jan.	5	78	Magruder, M. 28 may.	6
6	Quinn, L. P. 25 jan.	4	79	Martin, T. C. 31 may.	1
7	Gruber, E. L. 25 jan.	5	80	Rogers, W. 31 july.	1
8	Neal, C. W. 25 jan.	1	81	Dougherty, L. R. 22 aug.	3
9	Cubbison, D. C. 25 jan.	2	82	Hopkins, S. R. 26 aug.	3
10	McKinlay, L. H. 25 jan.	1	83	Hollingsworth, C. P. 6 sept.	4
11	Osborne, T. D. 25 jan.	5	84	Daly, C. D. 5 mar. 13	3
12	Seagrave, D. 25 jan.	86	85	Palmer, A. K. C. 22 Nov.	1
13	Dodds, W. H., jr. 25 jan.	1	86	Stewart, F. W. 13 june. 14	4
14	Lund, J. 25 jan.	.....	87	Hayden, H. 18 nov. 14	4
15	Hammond, J. S. 25 jan.	3	<i>Second Lieutenants.</i>		
16	Bishop, A. T. 25 jan.	6	1	Ahern, L. J. 11 june.	.....
17	Carter, A. H. 25 jan.	3	2	Beere, D. M. 11 june.	.....
18	Prosser, W. E. 25 jan.	4	3	Erlenkotter, H. 11 june.	4
19	Riley, J. W. 25 jan.	2	4	Thummel, C. B. 11 june.	.....
20	Huntley, H. W. 25 jan.	1	5	Miner, H. E. 11 june.	.....
21	Smith, E. De L. 25 jan.	3	6	Greble, E. St. J., jr. 11 june.	3
22	Pennell, R. McT. 6 july, 07	5	7	Devers, J. L. 11 june.	4
23	Sturgill, W. S. 7 july.	.....	8	Taliaferro, L. H. 14 july.	6
24	Miles, S. 8 july.	.....	9	Bateman, H. H. 14 july.	3
25	Parker, C. 8 july.	2	10	Turner, F. A. 13 nov.	6
26	Burleson, R. C. 9 july.	3	11	Seaman, G. G. 13 nov.	2
27	Gilmor, A. 10 july.	.....	12	Reynolds, C. C. 13 nov.	5
28	Starkey, J. R. 11 july.	6	13	Gay, G. S. 18 jan. 10	1
29	Hoyle, R. E. DeR. 11 july.	6	14	Wallace, F. C. 15 june.	3
30	Olmstead, D. 12 july.	3	15	Lewis, B. O. 15 june.	.....
31	Maul, J. C. 12 july.	6	16	Odell, H. R. 15 june.	3
32	Hall, A. L. 13 july.	.....	17	Selleck, C. A. 15 june.	1
33	Paine, G. H. 13 july.	3	18	Dawley, E. J. 15 june.	2
34	Collins, L. P. 16 july.	4	19	Beard, L. A. 15 june.	1
35	Lyerly, B. 19 july.	1	20	Jones, I. 15 june.	1
36	Lewis, R. H. 26 july.	2	21	Goetz, R. C. F. 17 aug.	1
37	Booker, P. W. 12 aug.	2	22	Peyron, B. R. 8 sept.	1
38	Pritchett, E. E. 5 mar. 08	2	23	Magruder, J. 9 sept.	2
39	Cruse, F. T. 1 july.	5	24	Riggs, E. F. 11 feb. 11	2
40	Marley, J. P. 20 july.	6	25	Nance, C. H. 13 june.	2
41	Potter, W. C. 25 aug.	1	26	Bowley, F. W. 13 june.	1
42	Pfeil, H. 17 sept.	1	27	Beatty, J. C. 13 june.	2
43	Merrill, W. W. 16 june. 09	6	28	Hatch, J. E. 13 june.	5
44	Downer, J. W. 10 sept.	3	29	Walker, C. A., jr. 13 june.	.....
45	Bailey, B. M. 29 sept.	.....	30	Simpson, B. W. 13 june.	3
46	Sharp, W. F. 30 sept.	5	31	Finch, N. G. 13 june.	6
47	Thorp, F., jr. 14 jan. 10	5	32	Hobbs, H. M. 14 june.	4
48	Tyndall, J. G. 3 mar. 11	6	33	Andrews, J. 15 june.	1
49	Sands, A. L. P. 11 mar.	6	34	Oliphant, T. G. M. 20 july.	5
50	George, C. P., jr. 11 mar.	6	35	Proctor, M. 20 july, 11	2
51	Harlow, C. W. 11 mar.	4	36	Wrona, W. J. 20 july.	4
52	Naylor, H. S. 11 mar.	1	37	Erwin, V. P. 19 aug.	6
53	Rucker, W. H. 11 mar.	2	38	Bloom, F. 27 sept.	5
54	Shepherd, W. H. 11 mar.	2	39	Meyer, V. 28 sept.	2
55	Randol, M. G. 11 mar.	6	40	Hicks, E. H. 28 sept.	6

FIELD ARTILLERY DIRECTORY—Continued.

No.	Name, rank, and date of rank.	Reg't.	No.	Name, rank, and date of rank.	
<i>Second Lieutenants</i>			<i>Second Lieutenants</i>		
41	Thomason, A. G. 29 sept.	4	64	Parker, E. P., jr. 30 nov.	3
42	Wilson, R. W. 6 oct.	2	65	Eager, J. M. 30 nov.	3
43	Morrow, N. P. 7 oct.	4	66	Scott, R. C. 15 jan. 13	4
44	Jones, L. E. 7 oct.	5	67	Eager, H. 25 mar.	4
45	Polk, N. N. 7 oct.	5	68	Young, W. C. 12 june,	5
46	Bradley, F. 2 dec.	.....	69	Crane, W. C., jr. 12 june,	6
47	Anderson, J. W. 3 dec.	6	70	Brewer, C. 12 june,	3
48	Deshon, P. 24 apr. 12	1	71	Cain, D. E. 12 june,	3
49	Barnes, J. F. 24 apr.	2	72	McMahon, J. E., jr. 12 june,	3
50	Vanderveer, H. C. 24 apr.	3	73	Clarkson, H. S. 26 june,	2
51	Andrus, C. 24 apr.	4	74	Eikel, J. 14 july,	4
52	Maxwell, R. L. 12 june,	1	75	Helmick, C. G. 18 july,	2
53	Browne, C. J. 12 june,	3	76	Sedlacek, E. 30 aug.	6
54	Hauser, J. N. 12 june,	5	77	Thurber, P. L. 12 june, 14	3
55	Greenwald, K. C. 12 june,	5	78	Houghton, W. C. 12 june,	6
56	Anderson, R. E. 12 june,	4	79	Wyeth, J. C. 12 june,	5
57	Gillespie, J. A. 12 june,	2	80	Harris, A. R. 12 june,	4
58	Bailey, W. M. 12 june,	6	81	Burr, J. G. 12 june, 14	5
59	von Holtzendorff, J. D. 22 july,	6	82	Anderson, J. B. 12 june,	6
60	Winton, W. F. 23 july,	1			
61	Frankenberger, B. 30 nov.	5		<i>Additional Second Lieutenants.</i>	
62	Austin, R. B. 30 nov.	6	t	Burr, W. E. 12 june,	5
63	Daly, J. O. 30 nov.	1			

MILITIA.

First Inspection District.

Capt. Robert Davis, Inspector, Boston, Mass.

Massachusetts.—H. Q., 1st Bn, Boston: Maj. J. H. Sherburne, Capt. R. F. Blake, Adjt.; Btry A, Boston: Capt. Richard K. Hale, 1st Lieut. N. Wigglesworth, 1st Lieut. E. B. Richardson, 2d Lieut. S. Allen, 2d Lieut. R. C. Ware; Btry B, Worcester: Capt. Edward W. Wheeler, 1st Lieut. Nicholas J. Smith, 1st Lieut. John F. J. Herbert, 2d Lieut. Walter J. Cookson, 2d Lieut. Arthur P. Trombly; Btry C, Lawrence: Capt. T. D. Howe, 1st Lieut. E. C. Dick, 1st Lieut. George McLane, 2d Lieut. W. W. Roberts, 2d Lieut. R. A. Daniels.

Connecticut.—Btry A, Branford: Capt. Frank H. Frisbie, 1st Lieut. Charles S. Yeomans.

Rhode Island.—Btry A, Providence: Capt. Everitte S. Chaffee, 1st Lieut. Rush Sturges, 1st Lieut. Wm. Gammell, Jr., 2d Lieut. Daniel Howland, 2d Lieut. Gerald T. Hanley.

Second Inspection District.

Capt. J. B. W. Corey and Lieut. Harry Pfeil, Inspectors, New York City.

New Jersey.—Btry A, East Orange: Capt. Claude E. Lanterman, 1st Lieut. Frederic A. Reimer, 1st Lieut. Harry P. Dickinson, 2d Lieut. Robert B. Treat, 2d Lieut. Edward C. James; Btry B, Camden: Capt. Samuel G. Barnard, 1st Lieut. William G. Hinderer, 1st Lieut. Chas. M. Ferat, Jr., 2d Lieut. Samuel R. English, 2d Lieut. Charles H. Hinderer.

New York.—H. Q., 1st Fld Arty, New York City: Col. Henry H. Rogers, Capt. Edward P. King, Jr., Adjt. Capt. Timothy W. Hoxie, Q. M., Capt. Edwin Emerson, Comry. Capt. Chas. C. Warren, Bn Adjt. Capt. Prentice Strong, Bn Adjt. 1st Lieut. Francis D. Bowne, Bn Q. M. and Comry, 1st Lieut. Alvan W. Perry, Bn Q. M. and Comry. Btry A, Syracuse: Capt. Guido F. Verbeck, 1st Lieut. George G. Bailey, 1st Lieut. Thomas E. Hitchcock, 2d Lieut. William H. Thomas, 2d Lieut. Edward R. Granger; Btry B, New York City: Capt. Theron R. Strong, 1st Lieut. Robt. D. Mills, 1st Lieut. Samuel W. Gaylor, Jr., 2d Lieut. Louis D. Fancher, 2d Lieut. Channing R. Toy; Btry C, Binghampton: Capt. Chas. R. Seymour, 1st Lieut. Arthur S. Douglas, 1st Lieut. John T. Shinnors, 2d Lieut. Charles G. Blakeslee; Btry D, New York City: Capt. James E. Austin, 1st Lieut. Philip N. Lawes, 1st Lieut. Benjamin Van Raden, 2d Lieut. Sylvester Simpson, 2d Lieut. Frederick J. Koch; Btry E, New York City: Capt. John T. Delaney, 1st Lieut. Robt. A. White, 1st Lieut. Leonard B. Smith, 2d Lieut. Frederick H. Ryan, 2d Lieut. Joseph H. de Rivera; Btry F, New York City: Capt. Harold Lawson, 1st Lieut. Raymond M. Reid, 2d Lieut. Frederick F. Moore, 2d Lieut. William T. Van Alstyne; H. Q., 2d Fld Arty, Brooklyn: Col. George A. Wingate, Lieut. Col. Frank H. Hines, Maj. Chauncey Matlock, Maj. Joseph I. Berry. Capt. De Witt C. Weld, Adjt. Capt. Louis F. Kuntz, Q. M. Capt. Wilbur T. Wright, Comry. Capt. Wm. B. Short, Bn Adjt. Capt. Eugene F. Lohr, Bn Adjt. 1st Lieut. Albert D. Washington, Bn Q. M. and Comry; Btry A, Brooklyn: Capt. Walter P. Fox; Btry B, Brooklyn: Capt. Lester C. Fox, 1st Lieut. Horst A. C. Albrecht, 1st Lieut. John D. Butt, 2d Lieut. Harry C. Miller; Btry C, Brooklyn: Capt. Albert S. Hamilton, 1st Lieut. Thomas A. Buys, 1st Lieut. Eugene A. Holmes, 2d Lieut. Walter H. Simonson; Btry D, New York City: Capt. James B. Richardson, 1st Lieut. Howard E. Sullivan, 1st Lieut. Alfred W. Weiner, 2d Lieut. Charles J. McGronan; Btry E, New York City: Capt. John J. Stephens, Jr., 1st Lieut. Francis T. Colby, 1st Lieut. Robert W. Marshall, 2d Lieut. Herbert C. Dienst; Btry F, New York City: Capt. William O. Richardson, 1st Lieut. Saml. E. McRichard, 1st Lieut. Charles H. King, 2d Lieut. Frederick W. Bergstein, 2d Lieut. Raymond L. Hoffman.

Third Inspection District.

Capt. Marlborough Churchill, Inspector, Washington, D. C.

District of Columbia.—1st Btry, Washington, D. C.: Capt. Louis C. Vogt, 1st Lieut. George G. Wilson, 2d Lieut. George A. Bonnet, 2d Lieut. Harry E. Shilling.

Pennsylvania.—Btry B, Pittsburgh: Capt. William T. Rees, 1st Lieut. Clinton T. Bundy, 1st Lieut. John S. Purucker, 2d Lieut. Chas. C. Williams, 2d Lieut. Chas. C. Benton; Btry C, Pheonixville: Capt. Chas. G. Cox, 1st Lieut. John S. Williams, 1st Lieut. Frederick S. Swier, 2d Lieut. Augustine S. Janeway, 2d Lieut. Samuel A. Whitaker; Btry D, Williamsport: Capt. Clarence W. Kiess, 1st Lieut. John D. Andrews, 2d Lieut. John H. Ball, 2d Lieut. Norman R. Hill.

Virginia.—H. Q., 1st Bn, Richmond: Maj. Thomas M. Wortham, Capt. William W. LaPrade, Adjt., 1st Lieut. Thomas Croxton Gordon, Q. M. and Comry; Btry A, Richmond: Capt. William M. Myers, 1st Lieut. Edward C. Rees, 1st Lieut. James C. Pollard, 2d Lieut. John T. Wood, 2d Lieut. Geo. H. Myers; Btry B, Norfolk: 2d Lieut. Lee F. Lawler; 2d Lieut. P. W. Kear; Btry C, Portsmouth: Capt. Harry A. Brinkley, 1st Lieut. Lewis W. Ditto, 1st Lieut. Irvin L. Leafe, 2d Lieut. Wm. J. Cooper, 2d Lieut. Walter J. Tennent.

Fourth Inspection District.

Lieut. B. M. Bailey, Inspector, Atlanta, Ga.

Alabama.—H. Q., 1st Bn, Birmingham: Maj. Leon S. Dorrance, Capt. Hartley A. Moon, Adjt; 1st Lieut. J. Alf Luckie, Q. M. and Comry; Btry A, Birmingham: Capt. Frank Flinn, 1st Lieut. Walter L. Furman, 2d Lieut. Robert L. Pittman; Btry C, Birmingham: Capt. Arthur V. Gregory, 1st Lieut. William S. Prichard, 2d Lieut. Julian P. Smith.

Georgia.—H. Q., 1st Bn, Savannah: Maj. Richard J. Davant; Btry A, Savannah: Capt. Edward G. Thompson, 1st Lieut. Edward G. Butler, 2d Lieut. Alexander R. MacDonell, 2d Lieut. Valentine Seyden; Btry B, Atlanta: Capt. Andrew J. McBride, Jr., 1st Lieut. John F. Hallman, 2d Lieut. Thomas W. Jones, 2d Lieut. Robert G. Mangum; Btry C, Savannah: Capt. Edward D. Wells, 1st Lieut. Joseph H. Thompson, 1st Lieut. Charles G. Lang, 2d Lieut. Cecil Cheves.

Louisiana.—H. Q., New Orleans: Maj. Allison Owen, Capt. Bryan Black, Adjt., 1st Lieut. Joseph C. Sanders, Q. M. and Comry; Btry A, New Orleans: Capt. James H. Beard, 1st Lieut. David L. Jamieson, 2d Lieut. Guy L. Cassels, 2d Lieut. William K. Nourse; Btry B, New Orleans: Capt. Schaumburg McGehee, 1st Lieut. James E. Edmonds, 1st Lieut. Edwin M. Kursheedt; Btry C, New Orleans: Capt. William M. Crane, 1st Lieut. Gabriel S. Adams, 1st Lieut. Stanley M. Lemarie, 2d Lieut. Thomas M. Harlee.

Fifth Inspection District.

Lieut. A. L. Hall, Inspector, Indianapolis, Ind.

Indiana.—Bn, H. Q., Indianapolis: Maj. Robert H. Tyndall; Btry A, Indianapolis: Capt. Frank W. Buschman, 1st Lieut. Mark A. Dawson, 1st Lieut. Chas. L. Watson, 2d Lieut. Carlos W. Bonham, 2d Lieut. Solon J. Carter; Btry B, Fort Wayne: Capt. Leonard F. Wood, 1st Lieut. Walter Beerman, 1st Lieut. Walter J. Long, 2d Lieut. F. L. Ulmer, 2d Lieut. F. B. Ladd; Btry C, Rockville: Capt. L. Dennis Williams, 1st Lieut. James F. Anderson, 1st Lieut. Frank J. Strain, 2d Lieut. Wm. D. Elliott, 2d Lieut. Forrest E. Dukes.

Michigan.—H. Q., 1st Bn, Lansing: Maj. Roy C. Vandercook, Capt. Labon K. Caster, Adjt., 2d Lieut. Robert E. Marsh, Q. M.; Btry A, Lansing: Capt. Chester B. McCormick, 1st Lieut. Amos H. Ashley, 1st Lieut. Edwin Spies, 2d Lieut. Fred G. Fuller, 2d Lieut. F. G. Chaddock; Btry B, Lansing: Capt. Martin C. Clippert, 1st Lieut. Donald M. Childs, 1st Lieut. Frank P. Dunnebacke, 2d Lieut. Chester E. Boelio, 2d Lieut. Jos. H. Lewis.

Ohio.—H. Q., Briggsdale: Maj. H. M. Bush, Capt. Carl H. Hirstius, Adjt., 1st Lieut. Harry W. Avery, Bn Q. M. and Comry; Btry A, Cleveland: Capt. Quida

A. Kulist, 1st Lieut. Fred T. Murdge, 2d Lieut. Everett C. Williams, Btry C, Briggsdale (Columbus): Capt. Herbert M. Hayward, 1st Lieut. Ray Elzey, 2d Lieut. Rodney E. Pierce, 2d Lieut. George H. Bartholomew; Btry D, Mt. Vernon: Capt. Arthur S. Thompson, 2d Lieut. Robt. D. Dowds, 2d Lieut. Vincent B. Welker.

Sixth Inspection District.

Illinois.—H. Q., Waukegan: Maj. Ashbel V. Smith, Capt. George H. Gould, 1st Lieut. William J. Garard, Q. M. and Comry.; Btry A, Danville: Capt. Orvill F. Hopper, 1st Lieut. Harvey J. McMillan, 1st Lieut. Fred Starkey, 2d Lieut. Leslie P. Livengood; Btry B, Chicago: Capt. Frank M. Course, 1st Lieut. Max E. Payne, 2d Lieut. James Tyrell, 2d Lieut. Edward E. Barclay; Btry C, Waukegan: 1st Lieut. Jos. R. Durkin, 1st Lieut. Fred C. Morey, 2d Lieut. Philo J. Burgess.

Wisconsin.—Btry A, 1st F. A., Milwaukee: Capt. Philip C. Westfahl, 1st Lieut. Alonzo J. Comstock, 1st Lieut. John G. Reed, 2d Lieut. William F. Fraedrichs.

Iowa.—Btry A, Clinton: Capt. Geo. W. Dulany, Jr., 1st Lieut. Jacob E. Brandt, 1st Lieut. James L. Oakes, 2d Lieut. Eugene J. Curtis, 2d Lieut. Martin Purcell.

Seventh Inspection District.

Capt. C. C. Pulis, Inspector, St. Paul, Minn.

Minnesota.—H. Q., 1st Fld Art., St. Paul: Col. Geo. C. Lambert, Lieut. Col. Wm. J. Murphy, Maj. Gates Johnson, Jr., 1st Bn, Maj. Geo. E. Leech, 2d Bn, Capt. Otto N. Rath, Adj., Capt. Fred L. Baker, Q. M., Capt. Wm. H. Donahue Comry, Capt. Chas. A. Green, Adj. 2d Bn, 1st Lieut. John H. Schoomaker, Q. M., 2d Bn, 2d Lieut. Jas. K. Scott, Jr., Q. M. 1st Bn; Btry A, St. Paul: Capt. Arthur G. Feuchert, 1st Lieut. John Hammerbacher, 1st Lieut. Henry A. Stempel, 2d Lieut. Otto K. Seidel; Btry B, St. Paul: Capt. Frederick A. Tiffany, 2d Lieut. Theodore A. Kuldunski; Btry C, St. Paul: Capt. Thomas J. O'Leary, 1st Lieut. John H. McDonald, 1st Lieut. Roger J. Finn, 2d Lieut. Philip J. McCauley; Btry D, Minneapolis: Capt. Irving C. Kupper, 1st Lieut. Douglas G. Burrill, 1st Lieut. Harold K. Crabbe, 2d Lieut. Ernest J. Wenberg; Btry E, Minneapolis: Capt. James E. Jensen, 1st Lieut. William S. Hale; Btry F, Minneapolis: Capt. Walter F. Rhinow, 1st Lieut. John J. Tooffe, 1st Lieut. Fletcher Rockwood, 2d Lieut. Walter J. Kennedy, 2d Lieut. William H. Kennedy.

Eighth Inspection District.

Lieut. Frank Thorp, Inspector, Kansas City, Mo.

Kansas.—Btry A, Topeka: Capt. Clarence G. Grimes, 1st Lieut. Martin C. Pennekamp, 1st Lieut. Dana T. Jennings, 2d Lieut. Frank E. Barnard, 2d Lieut. Charles E. Edwards.

Missouri.—Btry A, St. Louis: 1st Lieut. Walter J. Warner, 2d Lieut. Edwin R. Niehaus; Btry B, Kansas City: 1st Lieut. Roy T. Olney, 1st Lieut. Arthur J. Elliott, 2d Lieut. Harry W. Ruttinger, 2d Lieut. Harman H. Kube.

Texas.—Btry A, Dallas: Capt. F. A. Logan, 1st Lieut. A. C. Allen, 1st Lieut. Sanford A. Stewart, Jr., 2d Lieut. Fred M. Logan.

Ninth Inspection District.

Lieut. W. F. Sharp Inspector, Denver, Col.

Colorado.—Btry A, Denver: 1st Lieut. John P. Donovan, 1st Lieut. William H. Schade, 2d Lieut. Harry O. Nichols.

New Mexico.—Btry A, Roswell: Capt. Charles M. de Bremond, 1st Lieut. James C. Hamilton, 1st Lieut. Willard F. Hird, 2d Lieut. Geo. M. Williams.

Utah.—1st Btry, Salt Lake City: Capt. William C. Webb, 1st Lieut. Curtis Y. Clawson, 2d Lieut. Paul W. Billings.

Tenth Inspection District.

Capt. E. H. Yule, Inspector, San Francisco, Cal.

California.—H. Q., 1st Bn, Oakland: Maj. Ralph J. Faneuf, Capt. Frederick W. H. Petersen, Adjt., 1st Lieut. John S. Riley, Q. M. and Comry; Btry A, Los Angeles: Capt. Reuben A. Ford, 1st Lieut. Jesse McComas, 1st Lieut. Samuel C. Haver, Jr., 2d Lieut. Harry L. Powell, Jr., 2d Lieut. Plummer H. Montgomery; Btry B, Oakland: Capt. Harry F. Huber, 1st Lieut. Charles J. Hogan, 1st Lieut. Edward E. Vicary, 2d Lieut. John W. White, 2d Lieut. Howard W. Enefer; Btry C, Stockton: Capt. Harry N. Howe, 1st Lieut. Otto E. Sandman, 2d Lieut. Charles H. Young, 2d Lieut. Asa M. Clark.

Oregon.—Btry A, Portland: Capt. Hiram U. Welch, 1st Lieut. Frank I. Randall, 1st Lieut. George B. Otterstedt, 2d Lieut. Bert V. Clayron, 2d Lieut. Charles L. Johnson.

Unassigned.

New Hampshire.—Btry A, Manchester: Capt. Edwin L. Towle, 1st Lieut. Frank J. Abbott, 1st Lieut. Henry A. Worthen, 2d Lieut. Lucius E. Hill, 2d Lieut. Geo. W. Upton.

ACTIVE MEMBERSHIP, FIELD ARTILLERY ASSOCIATION.

Arranged by percentages in each regiment in the regular service and in the organized militia of each state.

3rd U. S. Artillery.....	81 per cent.
4th U. S. Artillery.....	81 per cent.
1st U. S. Artillery.....	78 per cent.
2d U. S. Artillery.....	78 per cent.
5th U. S. Artillery.....	70 per cent.
6th U. S. Artillery.....	67 per cent.
New Mexico.....	100 per cent.
Massachusetts.....	71 per cent.
Ohio.....	62 per cent.
Connecticut.....	50 per cent.
Illinois.....	43 per cent.
Rhode Island.....	40 per cent.
Pennsylvania.....	36 per cent.
Colorado.....	33 per cent.
Missouri.....	33 per cent.
District of Columbia.....	25 per cent.
Texas.....	25 per cent.
Wisconsin.....	25 per cent.
Michigan.....	23 per cent.
New Jersey.....	20 per cent.
New York.....	20 per cent.
Indiana.....	19 per cent.
Minnesota.....	18 per cent.
Louisiana.....	14 per cent.
Virginia.....	12 per cent.
Georgia.....	8 per cent.
California.....	6 per cent.
Alabama.....	0 per cent.
Iowa.....	0 per cent.
Kansas.....	0 per cent.
New Hampshire.....	0 per cent.
Oregon.....	0 per cent.
Utah.....	0 per cent.

ANNUAL MEETING OF THE UNITED STATES FIELD ARTILLERY ASSOCIATION.

The annual meeting of the United States Field Artillery Association was held in Washington, D. C., at 11:00 a. m., in Room 456, War Department.

Four active members were present in person and one hundred and sixty-five active members were represented by written proxies. This representation comprised a majority of the active members of the association now in the United States.

Brigadier General Montgomery M. Macomb, United States Army, was reelected as a member of the Executive Council. Major Roy C. Vandercook, Field Artillery, National Guard of Michigan, and Major John H. Sherbourne, Field Artillery, National Guard of Massachusetts, were elected members of the Executive Council, vice Colonel H. H. Rogers, 1st Field Artillery, National Guard of New York, and Colonel George C. Lambert, 1st Field Artillery, National Guard of Minnesota, whose terms had expired.

The accounts of the treasurer were submitted and approved. A brief statement of the accounts is as follows:

RECEIPTS.	
Balance on hand December 1, 1913	\$803.67
Subscriptions, copies sold, and sale of pamphlets	1,322.40
Advertisements.....	200.87
	\$2,326.94
EXPENDITURES.	
Printing, engraving, postage, stationery, etc.	\$1,460.13
Office equipment.....	55.85
Clerk hire.....	240.00
Telegrams, notarial fees and express charges	3.25
Copyright fees	4.00
Refunds (overcharges).....	5.00
Members' subscriptions to other magazines and pamphlets bought for members.....	54.00
	\$1,822.73
Balance on hand, November 30, 1914	\$ 504.21

The treasurer also submitted a statement in which it was shown that, in spite of the reduction of the subscription to the FIELD ARTILLERY JOURNAL from \$4.00 to \$3.00 per annum which was voted at the last annual meeting, the normal expenditures and receipts have been such as to justify the reduction in price, as the increased expenditure

for the year has been caused chiefly by the unusual amount of tabular work in the June, 1914, number of the FIELD ARTILLERY JOURNAL.

As there was no other business before it, the meeting adjourned.

At the conclusion of the annual meeting, the Executive Council met and made the following appointments:

Colonel Charles G. Treat, General Staff, to be vice-president of the association, vice Colonel E. St. John Greble, 6th Field Artillery.

Lieutenant Colonel Charles T. Menoher, 3rd Field Artillery, to be a member of the Executive Council until the next annual meeting, vice Major William J. Snow, 2nd Field Artillery, whose resignation was accepted to take effect December 14, due to his assignment to duty in the Philippine Department.

BOOK REVIEWS.

The Great War. By Frank H. Simonds. Published by Mitchell Kennerly, New York. 1 vol., 8 vo. Price, \$1.50.

This book is America's first contribution to the literature which will be inspired by the great conflict which is being waged in Europe. Although the progress of the war will make it necessary to modify many of the statements, interpretations and conclusions contained in the book, the underlying causes of the war and the military and political meaning of its first phase will probably never be better presented.

Mr. Simonds has prepared himself for his task by many years of painstaking study of European political geography; and his accurate conception of the military aspects of the conflict leaves nothing to be desired. As the editor of the *New York Evening Sun*, Mr. Simonds has occupied a very prominent place in the ranks of the many editors who are endeavoring to interpret the European War; and there are many of his readers who believe that no other editor has so well succeeded in understanding the true meaning of past history and the motives of the men who influenced it, in portraying present conditions, and in looking forward to the ultimate effect of the war upon the history of the world.

As is stated in the preface the book is simply a collection of articles based upon editorial comment on some, but by no means upon all, of the more considerable aspects of the first two months of the war written close to the event and presented with the complete recognition of the limitations of such comment.

It is always interesting to military men to read military history written impartially by a discriminating non-military author; and Mr. Simonds' book should always have a prominent place in any military library for the reason that it is a wonderfully illuminating collection of contemporaneous comment which, although the work of an expert editor, cannot but also be a record of the sentiment of our country at the opening of the greatest conflict of modern times.

Seventy Problems. Infantry Tactics. By Colonel John F. Morrison, United States Infantry. Published by The United States Cavalry Association, Fort Leavenworth, Kansas. Price, for the text alone, \$2.00. For the maps, unmounted in case, \$1.25 per set. Maps mounted on cloth, in a roll, \$2.10 per set.

This is a compilation of problems selected from the best that the Army Service Schools have produced during the past six years, and as a study of infantry tactics, is by all odds, the best that has yet appeared in this country. The work has been ably edited, and more attractively arranged and printed than is usual in technical works.

Though primarily an infantry work, there is necessarily much dealing with artillery matters. For the field artilleryman it furnishes an excellent aid in appreciating the views and methods of the infantry, an appreciation so necessary to him in cooperation. Colonel Morrison's discussions of minor

tactics, advance and rear guard and outpost duties, and infantry tactics in general, are short, crisp and vigorous. In the last named he goes deeply into the human element, that all-important factor that is only too often forgotten.

There is a comprehensive study of the question of small arms ammunition supply, suggested regulations for it, and problems dealing with the involved and troublesome, but wholly necessary and almost as wholly neglected, questions of the line of communications. It is a book that should find a place in every officer's study, not on the shelves, but on the table.

E. D. SCOTT, Captain, 6th Field Artillery.

Manual of Military Training. By Captain James A. Moss, 29th Infantry. George Banta Publishing Company, Menasha, Wisconsin. One vol., \$1.90.

This book is a compendium of general military knowledge which, although designed primarily for infantry, will serve officers of other arms as an excellent reference book. In one volume are combined the essentials of Infantry Drill Regulations, Manual of the Bayonet, Manual of Physical Training, Manual of Interior Guard Duty, Field Service Regulations, Small Arms Firing Manual, Minor Tactics, Map Reading and Map Sketching.

For officers of Field Artillery who are prone to devote the great proportion of their time to a study of their own special tasks, the book should prove of great value for the reason that, in small space and with great brevity and clearness, they will find in it an outline of everything which they require to become well informed on general military subjects.

The manual consists of seven hundred pages, three hundred and fifty illustrations, two maps, and three war-game scale diagrams.

The Field Artillery Journal

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