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APRIL-JUNE, 1915

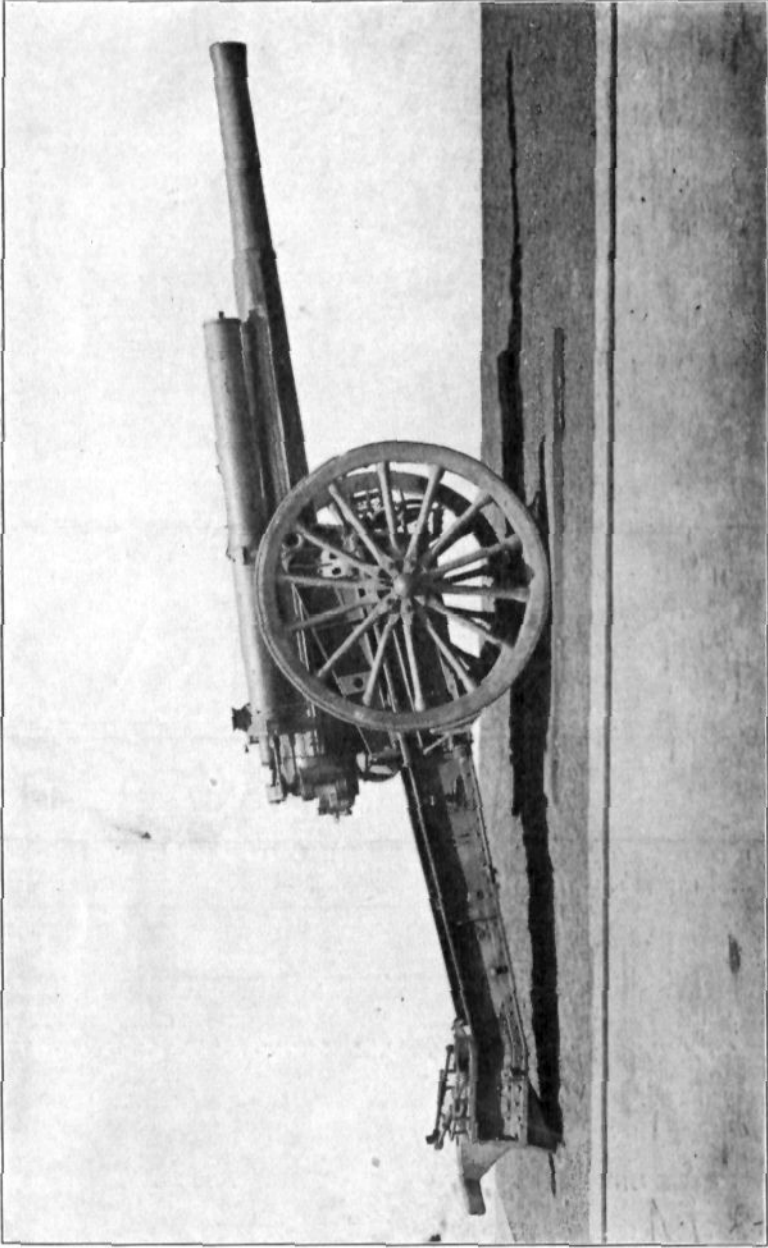
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BRITISH 60-POUNDER FIELD GUN. CALIBER, 5 INCHES. INITIAL VELOCITY, 2137 F. S.

The Field Artillery Journal

Vol. V

APRIL-JUNE, 1915

No. 2

THE SINGLE OBSERVATION RANGE FINDER.

By CAPT. LESLIE J. MCNAIR, 4TH FIELD ARTILLERY

ITS CONSTRUCTION, USE AND EFFECT ON FIELD ARTILLERY FIRING.

The single observation, self-contained range finder is a notable addition to the many advances of recent years in optical instruments for field artillery use. It is a remarkable achievement in optical manufacture and affords important advantages in practical use.

In 1913 the Goerz 1-meter base instrument of this type was adopted for our Field Artillery. The manufacturer's description, with cuts, was published in the FIELD ARTILLERY JOURNAL for January-March, 1915. What follows is intended to further acquaint Field Artillery officers with range finders and the results obtained in the service use of them at the School of Fire for Field Artillery.

Endeavor will be made to confine the discussion to facts and accomplished results. These are taken either from the School of Fire records and publications or from observations of the writer at the school. Responsibility for opinions given and conclusions drawn rests with the writer personally.

The type of the service range finder is not a new one, the Barr & Stroud instrument of essentially similar design having been patented in 1888. Such instruments, though larger, have long been in use on naval vessels and in Coast Artillery works; but it is only in recent years that they have been sufficiently perfected to meet the relatively severe requirements of Field Artillery service.

The competitive test of range finders for field artillery, which led to the adoption of the present service instrument, began at the School of Fire in 1912. In the test were included single observation instruments of four manufacturers as well as several types of two observation instruments, including the former service type of Weldon range finder. All but the self-contained, single observation instrument were quickly eliminated.

In general, it may be said that the Goerz instrument excelled all

others considerably and consistently in accuracy; and was equal to, or excelled, the others in speed of range finding and in the number of targets found. An instrument of the same manufacture and general type has been adopted for the Infantry as a result of tests independent of those conducted by the Field Artillery.

Beginning with the fall term of the School of Fire in 1914, the range finder was used in firing problems. Owing, however, to the shortage of instruments, the Goerz has not been used exclusively. It was assigned to one of the two instruction batteries; while the other used a Zeiss instrument, of very similar type, which had given excellent results in the competitive test. The Zeiss instrument is inferior to the Goerz in accuracy; but this is due, it is believed, principally, if not altogether, to its lesser power. The Goerz is 15-power and the Zeiss 10-power.

The results given hereafter of the use of the range finder include all firing problems in which the range finder has been used, whether of Goerz or Zeiss manufacture; and because of the lesser accuracy of the Zeiss instrument, the combined results should be poorer than may be expected in service, and conclusions drawn from them may be considered as conservative.

Construction

The service range finder is an instrument sealed to troops, and hence it is unnecessary to here go into the details of its construction. The principal features are, however, of interest.

The measurement of range is made by the observation and simultaneous solution of the triangle shown in Fig. 1, in which T is the target and RF the range-finder base. TR and TF are the rays from the target, which enter the left and right extremities of the instrument, respectively. When the target is at an infinite distance, the rays TR and TF, proceeding from it to the two extremities of the instrument, are parallel. The base RF and the angle TRF are fixed, so that the range measurement is a question of observing the angle TFR or its complement, TFT'. For a 1-meter base instrument, when the target is at the least range which can be measured, 600 yards, the angle TFR is about $89^{\circ}54'$; and when the target is at infinity, this angle is, of course, 90° . In other words, the measurement of ranges between 600 yards and infinity involves a subdivision into many parts of an angle of $6'$. In view of this fact, the accuracy obtained in practice under varying conditions must be

regarded as remarkable. It should further serve to impress all who handle the range finder with the necessity for treating it as a delicate instrument.

Fig. 2 shows diagrammatically the principal features of the range finder. A number of parts are, for simplicity, omitted. It is intended merely to exemplify the type.

P and P' are pentagonal reflecting prisms at the extremities of

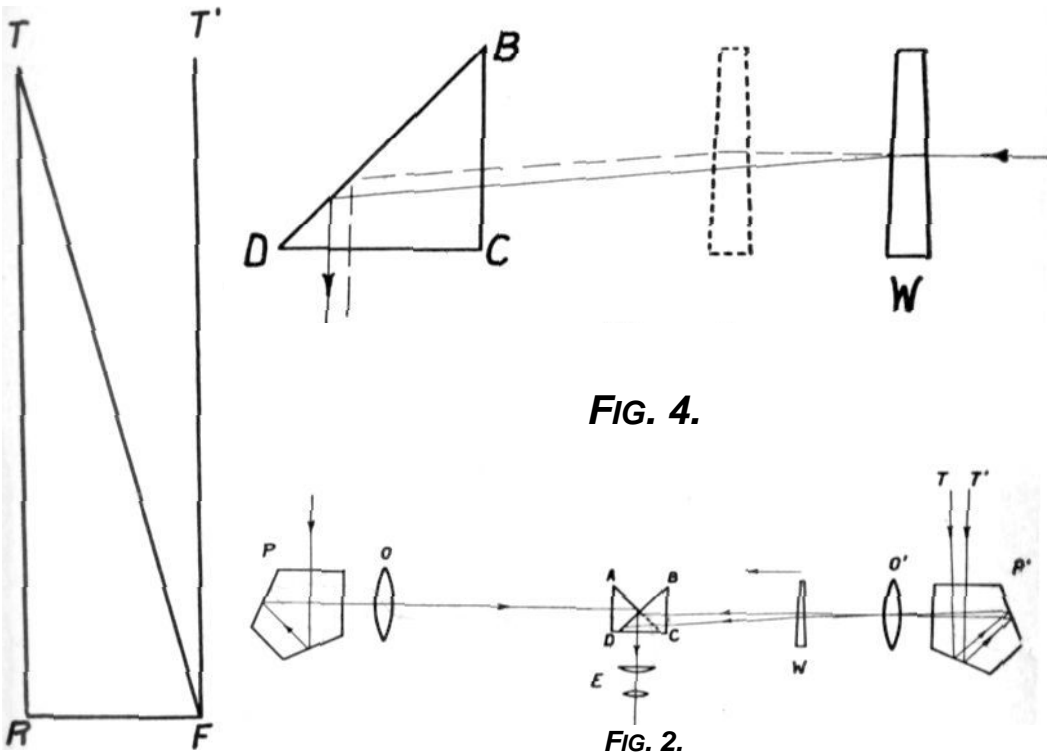


FIG. 1.

FIG. 4.

FIG. 2.

the instrument, the reflecting surfaces being silvered. The ray emerges from these prisms perpendicular to the direction of entrance, regardless of the direction of entrance with respect to the reflecting surfaces.

O and O' are the objective lenses.

ACD is a reflecting prism which receives the ray from the left extremity of the instrument and reflects it into the eyepiece.

BCD is a similar prism placed beside ACD, but faced in the

opposite direction to receive the ray from the right extremity of the instrument.

E is the eyepiece.

In this type, known as the upper invert, the image formed by the left objective appears only in the lower half of the field of the eyepiece erect and unreversed (right for left). The image formed by the right objective appears only in the upper half of the field of the eyepiece inverted but unreversed. See Fig. 3. This arrangement

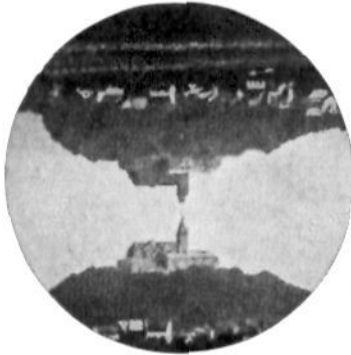


FIG. 3

facilitates obtaining coincidence of images. The inverted and reversed images formed by the objectives are both reversed a second time by the prisms ACD and BCD and appear unreversed. The erection of the image formed by the left objective is not shown.

W is a refracting prism of wedge shape placed between the right objective and its focal point. It can be moved laterally by means of the measuring screw. This movement permits lateral coincidence of the images. After a ray from the right of the instrument passes through this prism, it is bent or refracted as shown in Fig. 4. It is seen that as the prism moves from right to left, the point where the ray emerges from the reflecting prism BCD moves from left to right. When W is in its extreme right position, the range scale reads infinity; and if the instrument is in adjustment for range, the upper and lower images of a very distant object are in lateral coincidence. In this case, the ray of T' of Fig. 2 enters the right extremity of the instrument. If a nearer object be viewed without moving W, the ray entering the right of the instrument may be represented by T. The ray entering the left of the instrument is unchanged. The ray T will emerge from the prism BCD to the

left of the ray T'. Hence the upper image, which is formed by rays from the right of the instrument, will be to the left of the lower image. To bring the two images back into lateral coincidence, W must be moved to the left to such a position as is indicated in dotted lines in Fig. 1. The amount of movement necessary gives, by means of the pointer attached to W and moving along the range scale, a direct indication of the range.

It is thus seen that when the upper image is to the left of the lower image, the range indicated on the scale is too great, provided the instrument is in adjustment for range. When the upper image is to the right of the lower, the range indicated is too small.

In viewing a moving target, if the upper image is moving to the left *with respect to the lower image*, the target is advancing; and if the upper image is moving to the right with respect to the lower, the target is retreating.

Similarly, if the instrument be set for accurate lateral coincidence on a target as in range finding, and the upper image of a burst is to the left of the lower image of the burst, the burst is short; if the upper image of the burst is to the right of the lower image, the burst is over the target.

Or, again, suppose the range scale to be set at the known range of an object and the instrument directed upon it. If the upper image be to the left of the lower image, the range finder is out of adjustment and will indicate ranges short of the actual ones. If the upper image is to the right of the lower one, the ranges indicated will be too great.

Use.

No detailed description of the use of the instrument is necessary here, as this is fully given in the preceding number of the FIELD ARTILLERY JOURNAL. There are several points, however, that have been emphasized by experience at the School of Fire; and these will be mentioned.

The two adjustments, for altitude and for range, are important. It is possible to find ranges with the instrument out of adjustment for altitude; that is, when the two images whose lateral coincidence is sought are not in conjunction vertically; but as the lateral coincidence must be *estimated* between two images separated vertically, it cannot be expected that the results will be satisfactory. In the case of moving targets, which in general have an oscillating movement in the field of view both vertically and horizontally, the

lateral coincidence is obtained on a constantly changing portion of the target vertically. There is no difficulty about this when the instrument is in adjustment for altitude; but if not, and the target have other than vertical outlines, a point of the outline at one height for the upper image will be brought into lateral coincidence with a point of the outline at a *different* height for the lower image. It must be expected that the resulting range, in this case, will be erroneous. Simple and easy as is the adjustment for altitude, it is apt to be neglected and should be the subject of careful supervision.

The most important adjustment is that for range, described on pages 172 and 173 of the preceding number of the FIELD ARTILLERY JOURNAL. There are three methods generally available for adjusting the instrument for range: the artificial infinity method, described by the manufacturer and using the adjusting bar; the actual infinity method, using the sun, moon, or a very distant point; and the known range method, using a point at a finite distance whose range is accurately known.

It is believed decidedly that the artificial infinity, or adjusting bar method is the best and should be habitually used. The reasons for this opinion are as follows: First, it is always available, no matter where the battery is operating; second, the accuracy of the principle is beyond question; and, third, the adjusting bar is relatively close to the instrument so that atmospheric disturbances do not impair its accuracy. An objection to the actual infinity and known range methods is that atmospheric disturbances, such as heat waves, generally render it difficult or impossible to obtain the necessary accuracy in coincidence; or, at best, require a higher degree of skill than the adjusting bar method. An objection to the use of the sun and moon is that the lateral coincidence is not obtained on vertical lines. Adjustment on the moon is considered objectionable because it must be done at night, when the instrument is at a different temperature from that at which it will be used. It is unreasonable to expect this to be without effect on the accuracy of the ranges found. The known range method is obviously one whose use will ordinarily be impossible in service, which should be sufficient to discourage its use in garrison, particularly when a better method is available at all times.

The use of gun ranges in adjusting for range is utterly out of the question, as will be seen later from the value given for the error of the range center, page 7. The old saying, to the effect that, after all, the gun is the best range finder, has some foundation in

fact; but this does not warrant its use in adjusting an instrument of the class of our new range finder. Nor should it be assumed that, because the use of the range finder range in firing gives burst intervals consistently short, or over, the instrument is out of adjustment. In such a case, it would be advisable to verify the range adjustment with adjusting bar; and, if correct, attribute the discrepancies to the atmospheric or other conditions affecting the shooting of the guns. An arbitrary correction of the announced range finder range to meet the observed discrepancies would be beneficial, provided the observed results were sufficiently extensive to be reliable and representative. For instance, in high altitudes, the guns may be expected to shoot over the range laid; and decreasing the rangefinder range before announcing it to the guns will, in general, decrease the distance of the first range used from the target.

It is not possible to adjust the instrument for the known gun range of a target and obtain correct gun ranges for targets at other ranges. The instrument is graduated, giving correct ranges, and will not give ranges automatically corrected to meet special conditions.

Attention is particularly invited to the last sub-paragraph of paragraph 4b, of page 173, of the preceding number of the *FIELD ARTILLERY JOURNAL*, in regard to basing the adjustment for range on several, and not one, observation of the adjusting bar; and in regard to noting, for future reference, the setting of the correction screw.

Endeavor will be made hereafter to show that the range finder should increase very considerably the fire efficiency of a battery. If the conclusions drawn are even partially accepted, it will be agreed, it is believed, that the operator of the range finder is a person of great importance in the battery machine. It follows that he, and his substitutes, should be selected with special care and trained to the highest possible extent. This matter is one to which the battery commander could well give his personal attention. The battery commander, and all of his officers, should be skilled in the use of the range finder. That officers may experience the necessity of finding ranges is readily conceivable; for instance, in case the observing ladder is used or the battery detail put out of action.

Training in the use of the range finder should include the care and adjustment of the instrument, and finding the range of stationary and moving targets. Preliminary training may be had by

merely verifying the coincidence obtained by the new operator, but should be completed by the finding of widely varying ranges accurately known from map or by triangulation, but strange to the operator. The difficulty of the targets should be progressively increased.

In determining the range of fixed targets, the operator should be required to make two or more determinations without looking at the scale, the reading for each setting being noted by the instructor. The agreement of the settings is in itself an indication of the reliability of the results. The operator should be trained to realize when he has a reliable range. In practice, when the range found is not reliable, the operator should so announce, or announce the range as not found. Probably the latter is the better method, as in case the range is unreliably found, the battery commander may better open fire with the range of a distinctly visible point which he estimates to be near the target.

Training with moving targets may be readily had by causing mounted or dismounted men to appear near predetermined points whose range is known. The direction, rate, and duration of the movement may be varied. The determination should also include the direction of movement, if any, in the direction of range. This has already been discussed under the construction of the instrument, page 3.

Accuracy is the first essential in an operator. Speed will develop with further training. In the competitive test of range finders at the School of Fire, the average time of finding the range of a fixed target was fifteen seconds, and of a moving target nine seconds. This was with supposedly trained operators.

It is emphasized that the training, or at least supervision, of an operator must not cease when he has reached the state where he is able to find ranges satisfactorily. It has been found that a thoroughly skilled operator may become careless; and, from his past success, get the idea that a painstaking coincidence is no longer necessary in his case. By an occasional test with known ranges, such disallusions may be quickly dispelled. In general, it may be stated that an operator may be kept in practice, as far as accuracy is concerned, only by the use of known ranges.

It was learned during the test of range finders that transportation is the source most productive of internal disorders in the instrument; and that habitual transport on wagons without springs will

sooner or later render the range finder unserviceable and necessitate its return to an arsenal or the maker for repair. A mounted man may carry the instrument and its tripod hung from his saddle, but for other than short distances this is too hard on the mount. In view of these facts, a special type of saddle, in the nature of a pack saddle, has been developed for the transport of the range finder and its tripod. The success of the saddle has not, as far as is known, been definitely established. The feasibility and advisability of this method of transport are considered doubtful. A suitable spring box on one of the carriages appears to be a better solution.

Effect of the Range Finder on Field Artillery Firing.

It is asserted at the outset that the range finder cannot, except in cases of extreme urgency, obviate the necessity for adjustment in range by the observation of fire. It can in no way alter or effect the correctness of the bracketing principle. The principal and most important use of the range finder is in determining the first range that should be used in attacking a target. By its use, the first range will, on the average, be much closer to the target than if this range were an estimated one. This fact permits the range change used prior to obtaining a bracket, ordinarily taken as 400 yards when the initial range is estimated, to be profitably reduced when the range finder is used, thus saving time and ammunition in adjustment. The determination of the best range change when using the range finder will now be investigated in detail.

As a fundamental principle, axiomatic in character, it is stated that the best range change is that which permits the securing of the bracket sought with the least expenditure, in the long run, of time and ammunition; provided that it does not, in any considerable number of individual cases, require an unduly large expenditure of time and ammunition. The principle that the range change should be such that the sense of the second range used will be the opposite of that of the first range used has no support in reason, and, as far as is known, no advantage in practice. To determine the best range change, based on the principle first stated, it is necessary to know the proximity to the target of the center of impact in range, or range center, of the first range used. This proximity may be expressed by the frequency in, say, a thousand cases with which the range center falls within 50 yards of the target, within 50 to 100 yards,

etc.; or, since the distance of the range center from the target follows the law of errors, as will be shown later, the proximity to the target of the range center may be expressed by the *probable distance*.

The distance from the target of the range center of the first range used is an error made up of two independent component errors, as follows:

The error of range finding, termed the *range finding error*.

The error of the range center with respect to the range laid; that is, the amount by which the gun fails to shoot true to range.

This will be termed the *error of the range center*.

In other words, if the range were determined without error and used by guns which shoot ideally, the range center would be at the target.

Both of the errors above enumerated have been carefully and quite extensively investigated at the School of Fire; and, while the values obtained will probably be somewhat modified by future experience, they are believed to be sufficiently exact for the purpose of this discussion.

Range Finding Errors.

Since the use of the range finder in actual firing at the School of Fire, there have been some 340 problems in which the ranges of the targets, both stationary and moving, were determined by the battery details under conditions fairly representative of those to be expected in service. In all of these problems, the actual range of the target was known by triangulation methods within a probable error of about 5 yards; or, for practical purposes, the true range was known. As was stated previously, the instruments used were no better than the new service instrument and probably somewhat inferior to it in some cases. The observers, changed a number of times, were enlisted men selected from the instruction batteries and specially instructed. There is no reason to believe that they were of other than the average skill that may be expected in any Regular or Militia battery. In the examination of the results, absolutely no elimination of poorly determined ranges was made. The known ranges, which varied from 1,000 to 5,000 yards, were collected into groups 1,000 to 2,000, 2,000 to 3,000, etc., together with the corresponding errors in range finding. The mean and probable errors

of each group were then found, and considered as the values corresponding to the mean of the known ranges composing the group. With the values thus obtained, a curve was plotted showing the probable error of range finding as a function of range. The following table shows the mean and probable errors of range finding, obtained in this manner. There are also included the mean error which the manufacturer states, on page 168 of the preceding number of the FIELD ARTILLERY JOURNAL, may be expected in practice:

RANGE FINDING ERRORS.

SCHOOL OF FIRE.

| Range Yards | Mean Error | Probable Error | Manufacturer Mean Error |
|----------------|------------|----------------|----------------------------|
| 1000 | 86 | 73 | 9 |
| 1500 | 91 | 77 | 21 |
| 2000 | 100 | 84 | 36 |
| 2500 | 109 | 92 | 57 |
| 3000 | 119 | 100 | 81 |
| 3500 | 129 | 109 | 108 |
| 4000 | 141 | 119 | 141 |
| 4500 | 153 | 129 | 186 |

The school of fire results and those of the manufacturer are seen to be considerably different. It is known that, as far as the capabilities of the instrument itself are concerned, the error in per cent. of range is proportional to the range; for instance, if the error is 20 yards at 2,000 yards, or 1 per cent., it should be 2 per cent., or 80 yards, at 4,000 yards. When, however, additional errors are introduced, due to faulty adjustment and unskilled observers, this relation of errors cannot be assumed to hold. Since it is the basis of the manufacturer's figures, they cannot be taken as reliable.

The School of Fire figures include both errors of adjustment and of range finding and are believed to be a reliable expression of our experience to date.

The statement of a probable error of range finding presumes that the law of errors is applicable in this case. There is no reason to doubt that this is true, since the errors in both adjustment and operation are in the nature of accidental errors. It is advisable, however, to verify this point. Of the groups of known ranges mentioned above in finding the range finding error, the group 3,000 to 4,000 was the most numerous, there being 158 ranges included in it. The probable error of range finding was determined to be 106 yards for the group. Assuming the applicability of the law of errors and using

a probable error of 106 yards, the portion of the 158 errors which should fall between 0 and 49, 50 and 100, etc., may be computed. The actual errors may then be examined and classified according to the same limits. This was done and the results are as follows:

| RANGE FINDING ERRORS. | | |
|-----------------------|-------------------|---------------|
| Errors | Calculated number | Actual number |
| 0 to 49 yards | 40 | 39 |
| 50 to 99 yards | 36 | 36 |
| 100 to 149 yards | 29 | 28 |
| 150 to 199 yards | 22 | 22 |
| 200 to 249 yards | 14 | 11 |
| 250 to 299 yards | 8 | 8 |
| 300 yards and over | 8 | 14 |
| | — | — |
| | 158 | 158 |

The law of errors is clearly applicable to range finding.

Errors of the Range Center.

For the past few years at the School of Fire, the error of the range center has been habitually determined for each firing problem. At present, 181 firing problems are available for examination in this respect. These were grouped according to range as in the case of the range finding errors, and the probable error of the range center determined for each group. This, as in the previous case, permitted the construction of a curve showing the probable error of the range center as a function of range. The results are as follows:

| PROBABLE ERROR OF THE RANGE CENTER—YARDS. | |
|---|----------------|
| Range | Probable Error |
| 1000 | 25 |
| 1500 | 36 |
| 2000 | 47 |
| 2500 | 58 |
| 3000 | 69 |
| 3500 | 80 |
| 4000 | 91 |
| 4500 | 102 |

The results are exactly proportional to the range. It is hardly likely that this is strictly correct. The values are believed, however, to be sufficiently close to the truth for the purpose of this discussion. It may be remarked that the data used covered firing in fairly equal amounts at all seasons of the year, except mid-winter; and also that, *on the average*, the guns shot practically to range.

The applicability of the law of errors to this class of errors might seem questionable. Taking the most numerous group of the problems examined in this respect, 2,000 to 3,000 containing ninety-five problems, the calculated and actual numbers of errors may be classified as in the case of range finding errors. The results are as follows:

ERRORS OF THE RANGE CENTER.

| Errors | Computed | Actual |
|--------------------|----------|--------|
| 0 to 49 yards | 40 | 40 |
| 50 to 99 yards | 30 | 29 |
| 100 to 149 yards | 16 | 19 |
| 150 to 199 yards | 6 | 6 |
| 200 yards and over | 3 | 1 |
| | 95 | 95 |

This shows that, for practical purposes at least, the error of the range center follows the law of errors.

Distance from the Target of the Range Center of the First Range Used.

Having evaluated the two sources of error which affect this distance, the range finding error and the error of the range center, the distance itself may be evaluated. It has been established that both the range finding error and the error of the range center follow the law of errors; and these are obviously independent sources of error. As is explained in the School of Fire publication on the theory of errors, the resultant of these two sources of errors follows the law of errors, and the resultant probable error is the square root of the sum of the squares of the component errors.

For a range of 2,000 yards, then, the probable distance from the target of the range center of the first range used is, from the values previously stated,

$$\sqrt{84^2 + 47^2} = 96 \text{ yards}$$

And for a range of 4000 yards,

$$\sqrt{119^2 + 91^2} = 150 \text{ yards}$$

In view of the importance of the conclusions to be later deduced from these values, and to convince the skeptical as to the substantial correctness of the methods and values employed in their determination, they will be investigated by actual experience. The school target reports covering all firing problems in which the range finder was used have been examined; and from them the mean burst interval,

corrected for height of burst, has been determined for the rangefinder range. This approximates the distance from the target of the range center of the first range used. The results were collected and tabulated in groups as follows: Group 1, all moving targets, direct laying, mean range 2,500 yards; group 2, stationary targets, battery and machine gun (taken because of the greater definiteness of the burst interval), using indirect laying, below 3,000 yards in range, mean range 2,500; group 3, same as group 2 except between ranges of 3,000 and 4,000 yards mean range 3,400 yards; and group 4, the same as group 2 except ranges of 4,000 yards and over, mean range 4,300 yards. The probable distance from the target of the range-finder range was determined for each group. Such a determination affords a good means of checking the results previously obtained by radically different methods.

The results obtained, together with those calculated from values previously given, are as follows:

| Group | From target report | Calculated |
|-------|--------------------|------------|
| 1 | 97 | 109 |
| 2 | 102 | 128 |
| 3 | 116 | 142 |
| 4 | 127 | 165 |

Groups 2, 3, and 4 have included in the calculated values the error in angle of site measurement 2.5 mils.

It will be noted at once that the values obtained from the target reports are uniformly less than the calculated ones. These differences cannot be definitely explained. They are due, in a measure at least, to the fact that the target reports covered firing only during the spring and fall, when the temperature conditions are fairly normal and the errors of the range center could be expected to be less than the average for the entire year. The values actually given for the probable error of the range center were, on the other hand, based upon firings which included the Militia Course when the errors of the range center are very considerable. It may be noted further that the values obtained from the target report in the above table are scarcely more than the range finding error alone; and this tends to show that the errors of the range center, in the problems examined were very small. It is believed that the calculated values are more representative than the target report results of what may be expected in the long run through a complete cycle of varying conditions. The target report values are useful in showing that the calculated values are conservative.

The applicability of the law of errors to the distance from the target of the range center of the first range used may be established from the target report analysis. The actual and calculated number of the various classes of errors are given in the table below.

| Errors | Group 1 | | Group 3 | |
|--------------------|------------|----------|------------|----------|
| | Calculated | Actual | Calculated | Actual |
| 0 to 49 yards | 24 | 23 | 22 | 23 |
| 50 to 99 yards | 22 | 23 | 20 | 18 |
| 100 to 149 yards | 17 | 19 | 17 | 18 |
| 150 to 199 yards | 13 | 11 | 12 | 12 |
| 200 to 249 yards | 7 | 4 | 10 | 8 |
| 250 to 299 yards | 3 | 5 | 7 | 5 |
| 300 yards and over | 4 | 5 | 8 | 12 |
| | <hr/> 90 | <hr/> 90 | <hr/> 96 | <hr/> 96 |

Best Range Change.

The results of experience have now been placed in a form suitable for determining the best range change for use with the range finder range, that is, by how much the range should best be changed after observing for range the first range used. The matter will be investigated for ranges of 2,000 and 4,000 yards.

The probable errors in the distance from the target of the range center of the first range used are as follows:

2000 yards, direct laying, $\sqrt{84^2 + 47^2} = 96$ yards.

2000 yards, indirect laying, $\sqrt{84^2 + 47^2 + 68^2} = 118$ yards.

4000 yards, indirect laying, $\sqrt{119^2 + 91^2 + 48^2} = 157$ yards.

The distribution about the target in the long run of cases of the range center of the first range used may now be easily determined by the law of errors. This will be done using 100 as the total number of cases.

| Limits of Errors | 2000 yards | 2000 yards | 4000 yards |
|------------------|---------------|-----------------|-----------------|
| | Direct Laying | Indirect Laying | Indirect Laying |
| 0 to 49 | 27 | 22 | 17 |
| 50 to 99 | 25 | 21 | 16 |
| 100 to 149 | 19 | 18 | 15 |
| 150 to 199 | 13 | 14 | 13 |
| 200 to 249 | 8 | 10 | 11 |
| 250 to 299 | 4 | 6 | 8 |
| 300 to 349 | 3 | 4 | 6 |
| 350 to 399 | 1 | 3 | 5 |
| 400 to 449 | | 1 | 4 |
| 450 to 499 | | 1 | 2 |
| 500 to 549 | | | 1 |
| 550 to 599 | | | 1 |
| 600 to 649 | | | 1 |
| | <hr/> 100 | <hr/> 100 | <hr/> 100 |

Knowing the relative frequency of the various positions of the range center of the first range used, the number of ranges that must be used to bracket the target with each of the different range changes may be computed. A complication arises due to the fact that the first or a subsequent range may bracket the target and make further range changes unnecessary. At least subsequent changes would have no relation to this discussion, and would be independent of the range change used up to this point. Without going into the details of the computation, it may be said that this condition of affairs has been fully taken into consideration. The battery salvo was assumed to be used, but the method of ranging will not affect the relative values of the results. Range changes, in this case, cease when a mixed or bracketing salvo is obtained, and at least one over and one short is observed. The following table shows the ammunition consumed, when using the various range changes, in obtaining brackets of 50, 100, and 200 yards. The firing at one range until the range is observed for range is taken as a unit for ammunition consumption; since the actual number of rounds consumed per range is, in the long run, independent of the range change.

| No. of ranges used per case. | 2,000 yards. Direct laying. | | | Total ranges to be used per 100 cases. 2,000 yards. Indirect laying. | | | 4,000 yards. Indirect laying. | | | | | |
|------------------------------|-----------------------------|-----|-----|--|-------------------|-----|-------------------------------|-----|-----|-----|-----|------|
| | 50 | 100 | 200 | 400 | 50 | 100 | 200 | 400 | 50 | 100 | 200 | 400* |
| 1 | 15 | 15 | 15 | | 13 | 13 | 13 | | 8 | 8 | 8 | |
| 2 | 56 | 46 | 28 | | 46 | 40 | 30 | | 36 | 24 | 22 | |
| 3 | 63 | 108 | 60 | | 57 | 99 | 63 | | 42 | 87 | 45 | |
| 4 | 60 | 72 | 172 | | 60 | 80 | 156 | | 56 | 88 | 164 | |
| 5 | 50 | 30 | 40 | | 55 | 45 | 60 | | 60 | 70 | 90 | |
| 6 | 30 | 12 | | | 48 | 18 | | | 60 | 48 | 42 | |
| 7 | 21 | | | | 28 | 14 | | | 56 | 28 | | |
| 8 | 16 | | | | 24 | | | | 32 | 24 | | |
| 9 | 9 | | | | 18 | | | | 36 | | | |
| 10 | | | | | 20 | | | | 40 | | | |
| 11 | | | | | | | | | 11 | | | |
| 12 | | | | | | | | | 12 | | | |
| 13 | | | | | | | | | 26 | | | |
| Totals..... | 320 | 283 | 315 | | 369 | 309 | 322 | | 475 | 377 | 371 | |
| | | | | | 100-yard bracket. | | | | | | | |
| 1 | | 15 | 15 | 15 | | 13 | 13 | | | 8 | 8 | 8 |
| 2 | | 96 | 30 | | | 80 | 30 | | | 62 | 22 | 8 |
| 3 | | 78 | 198 | 42 | | 84 | 165 | | | 81 | 153 | 33 |
| 4 | | 32 | 16 | 284 | | 48 | 60 | | | 64 | 88 | 276 |
| 5 | | 15 | | | | 25 | 10 | | | 50 | 40 | 40 |
| 6 | | | | | | 12 | | | | 30 | | |
| 7 | | | | | | 21 | | | | | | |
| Totals..... | | 236 | 259 | 341 | | 262 | 278 | | | 316 | 311 | 365 |
| | | | | | 200-yard bracket. | | | | | | | |
| 1 | | | 15 | 15 | | | | | | 8 | 8 | |
| 2 | | | 148 | | | | | | | 116 | 8 | |
| 3 | | | 33 | 255 | | | | | | 78 | 240 | |
| 4 | | | | | | | | | | 32 | 32 | |
| | | | 196 | 270 | | | | | | 234 | 288 | |

* Range change used until the target is bracketed.

The 50-yard bracket was inserted in the above table to illustrate the fact that the range change can be so reduced as to waste ammunition and also make the number of ranges than must be used in particular cases excessively large. It is clearly shown that there is no support for the use of the 400-yard change.

As between the 100-yard and 200-yard change, it is seen that the ammunition used is very nearly the same for both, the 100-yard change being more economical at the short ranges and the 200-yard change more so at the long ranges. The 200-yard change has the advantage of requiring fewer ranges in the extreme case. All things considered, the 200-yard change is considered preferable for general practice. It is not at all beyond the range of possibility that skill in the use of the ranger finder may improve to a sufficient extent to make the 100-yard change distinctly preferable.

The principle of range change which appears warranted from the foregoing investigation may be stated as follows: Against fixed targets, when the range finder range is available, it should be used for the first firing; and after it is observed for range, changes of 200 yards should be made until a bracket is obtained.

Moving Targets.

The attack of moving targets is materially influenced by the use of the range finder. The School of Fire experience affords no reason for believing that the ranges of moving targets are less accurately found than those of fixed targets at the same range. In the analysis of target reports to ascertain the probable distance from the target of the range center of the first range used, the results of which are discussed on page 9, it was found that this probable error was 97 yards in the case of moving targets and 102 yards in the case of fixed targets. Both of these groups had the same range, 2,500 yards. It is not contended that the range of a fixed target is not easier to find than that of a moving one; but in actual experience, the lack of definition and visibility apparently affect the accuracy of the ranges found for fixed targets. In any event, the best information at hand indicates that there is no marked difference in the accuracy of range finding in the cases of fixed and moving targets.

The element of time enters into the attack of moving targets, and must be expected to do so. It is found from the School of Fire targets reports that the average time a moving target is exposed to

fire is ninety-one seconds. Fifteen seconds of this time is consumed in preparing to fire, and the remaining seventy-six seconds in firing. The average interval between volleys in ranging, including the interval between ranging and fire for effect, is twenty-two seconds; and in fire for effect, fourteen seconds between volleys. The number of volleys necessary on the average to observe a range for range may be taken a 1.4. These values may not be correct for service conditions, but they are the best obtainable; and are better than a guess.

The merit of a method of fire against moving targets must be based entirely on whether or not it produces effect in the short time such targets are exposed. The fact that a good bracket has been obtained and fire for effect is about to be opened when the target disappears does not make the firing any less a failure. It is considered that fire for effect is successful when a depth in range containing the target has been searched by range changes of 100 yards.

Three methods of attacking a moving target will be briefly considered:

- (a) Fire for effect without ranging or bracketing.
- (b) Fire for effect after observing the first range, that of the range finder.
- (c) Fire for effect after observing a bracket.

Assuming the mean range of moving targets to be 2,500 yards, as found from the School of Fire firings, the probable distance from the target of the range center of the first range used may be computed from values previously given, and found to be 109 yards. The probability that the range center will be within 400 yards of the target is 98 per cent., considerably nearer a certainty than the correctness of observation of fire by officers in general. The probability that the range center will be within 300 yards of the target is 91 per cent. For the ninety moving target problems whose records were examined in this respect (page 9), the range center of the first range used was within 300 yards of the target in 95 per cent. of the problems, and within 400 yards in 99 per cent. of them.

(a) If it is desired to proceed to fire for effect without ranging, it is obviously necessary to cover a depth in range of 800 yards, or a depth of 600 yards if a probability of over 90 per cent. is considered sufficient assurance of success. To cover 800 yards in depth would require 7×14 seconds or ninety-eight seconds. To cover 600

yards in depth would require seventy seconds. The disadvantages of the method are: The corrector and deflection are not necessarily adjusted at the beginning of the fire. The direction of the motion of the target must be known before fire can be begun, and this may cause delay. The fire is begun at the range where the target is least likely to be, and the range which is *most* probably that of the target is not reached until the fire is half completed. This is undesirable since it is not known when the target may disappear.

(b) Since it is almost a certainty that the first range used will be within 400 yards of the target, there can be no reasonable excuse, other than lack of adjustment of corrector and deflection, for firing in ranging at the second limit of a 400-yard bracket after the first limit has been observed. Fire for effect should be begun immediately after observing the first range used, starting at the appropriate limit of the assumed bracket and covering 400 yards. Computing the time required as under "a" the ranging will require, on the average, 1.4 volleys or thirty-one seconds; and the fire for effect $3 \times 14 = 42$ seconds; a total of seventy-three seconds for firing. If only 300 yards were to be covered, the time of fire would be $31 + 28 = 59$ seconds. It is seen that this method is superior to "a" in time and ammunition, and does not possess the disadvantages given under "a" or at least not to the same extent. It is clear that this is a promising method, even against very fleeting targets.

In the case of rapidly moving targets, the method should be modified. If, for example, the target were retreating cavalry and the first range were observed short, an increase of range of 400 yards would give overs in only 75 per cent. of cases when the target has a speed of 20 miles per hour and in 93 per cent. of cases when the target has a speed of 10 miles per hour. If the range be increased by 500 yards, the second range will give overs in 92 per cent. of cases when the target has a speed of 20 miles per hour. In cases of this nature, where the target is moving very rapidly, it is advisable to assume the bracket as 500 instead of 400 yards.

(c) Considering a 400-yard bracket obtained by observing both ranges, it is seen from facts previously stated that the second range observed is wasted in all except the most extreme cases. This additional sureness $1.4 \times 22 = 31$ seconds in every case where it is obtained, which is nearly one half of the seventy-six seconds available, on the average, for firing. The actual time required by this method is $62 + 42 = 104$ seconds, which is considerably in excess of

the time ordinarily available. If, as will frequently be the case, it is necessary to verify the first limit of the bracket after obtaining the second, the time becomes $93+42=135$ seconds, the entire period available for firing being consumed in ranging fire. The slowness and consequent lack of success its use will entail are believed to make its use inadvisable.

Method "b" is seen to offer the largest measure of success when it is considered, as was previously pointed out, that failure due only to the disappearance of the target does not differ practically from the case where failure is due to not obtaining the bracket correctly.

In view of the advantage the range finder offers in the attack of moving targets, it is of importance to investigate the question of how long, if at all, the battery commander is justified in waiting for the range finder range in case it is delayed. If the range finder is not used, an estimated range must ordinarily be used. It will be assumed that the estimated range will be within 600 yards of a moving target in 95 per cent. of cases, or nearly a certainty. Then it would, by the law of errors, be within 400 yards of the target in 80 per cent. of cases. Using a 600-yard bracket, the target would require 132 seconds for the firing. If the 400-yard bracket were used and obtained the first attempt, the time required for firing would be 104 seconds. If the 400-yard bracket were not obtained until the second attempt, the time of firing would be 135 seconds. Since the former condition obtains in 80 per cent. of cases and the latter in 20 per cent. of cases, the average time may be found by combining the two times in proper proportions and is 110 seconds. Now since effect can be obtained by method "b," in this case, in seventy-three seconds, it is seen that the battery commander may wait for the range finder range up to $110-73=37$ seconds. There can be no excuse for the range not being found in far less time than this, unless it cannot be found at all. In the latter case the operator should so report at once. Hence the conclusion that it is a saving of time to wait for the range finder range. In this determination, the cases where it is necessary to verify one limit of the bracket are neglected.

In the cases of slow-moving targets where a 200-yard bracket is sought, the principles deduced in the case of fixed targets are applicable and the range change should be 200 yards.

In this paper, an honest endeavor has been made to investigate the effect of the range finder; using as a basis nothing but established facts or the results of actual experience, and wholly without regard

to preconceived opinions and present or former practice. Since the range finder has now been in current use at the School of Fire for nearly two years, it cannot be characterized as premature if definite conclusions are drawn from the experiences to date. It is believed to be now expedient to formulate regulations covering the conduct of fire when the range finder is used, in order that full advantage may be taken of its capabilities.

It is realized that the experiences upon which this paper are based may not be borne out in practice generally, but there is no reason to suppose otherwise. As a precaution against false conclusions, however, it is believed best to put to general test in service practice such principles as have been deduced, or similar ones, before accepting them as correct.

The following is a summary of the points it is most desired to emphasize:

1. The range finder is a delicate instrument and should be handled and transported as such.

2. Great importance should be attached to the training of the operators. Accuracy is the first essential in this training, then speed, and with both, the ability to recognize a range not reliably found and the honesty to promptly inform the battery commander of the fact.

3. In the use of the range finder range in firing, the battery commander should take full advantage of what he has a right to expect of it as follows:

- (a) Against fixed targets, use of range change of 200 yards until a bracket or effective range is obtained.

- (b) Against moving targets, wait for the range finder range or a report that it cannot be obtained. Open fire at the range finder range; and, after observing this range, assume that a 400-yard bracket has been obtained and fire for effect, beginning at the appropriate limit. In the case of very rapidly advancing or retreating targets, the assumed bracket may best be taken as 500 yards when the first range is observed in the sense *away* from which the target is moving.

4. Such provisional authority should be given the service as will permit a practical trial of these or similar principles.

UNITED STATES MARINE CORPS FIELD ARTILLERY

BY CAPT. R. O. UNDERWOOD, UNITED STATES MARINE CORPS.

Since the formation of the United States Government, it has been its policy to maintain a military body under the Navy Department for the purpose of conducting its military operations on shore in the various parts of the world, where such operations have been found to be necessary for the protection of American lives and interests, and where they were of such minor character as not to require the presence of the Army. This military duty has nearly always devolved upon the Marine Corps, although on a number of occasions in the history of our country, and in recent years, the Navy and Marines have served jointly in military operations on shore.

Each battleship with the fleet and each large cruiser carries a company of about seventy marines, and the smaller cruisers, and at times the gunboats, carry from eighteen to thirty marines. These marines attached to the cruising vessels are virtually infantry forces. While all the marines are trained in handling certain of the guns of the secondary battery of vessels, their principal training is along the line of infantry, and their presence with the fleet, considered from its broadest view, is rendered necessary to sieze and hold any point of military value to the country especially where future operations are contemplated. The latest example of their value to the fleet was demonstrated in the capture of Vera Cruz, Mexico.

The fleet marines are organized so that when any two detachments landed from two ships are combined, they constitute a company of about 140 men. The rank of the officers commanding the ship's detachments is apportioned in such manner that when they are combined there will be one captain, one first and one second lieutenant in each of the companies. The field officers are carried on the flagship of the commander-in-chief, and on the division commander's flagships.

With the Atlantic Fleet consisting of twenty-one battleships, it will be seen that there is an effective infantry regiment consisting of ten companies of approximately 140 men each with this fleet, which is at all times ready for military operations on shore. These marines carry with them in the ships a full supply of camp and field equipment necessary to make themselves comfortable wherever they land, but are not equipped with means of transportation for operating

at a distance from their base, although on numerous occasions they have seized transportation sufficient to enable them to operate a considerable distance from their base.

The Navy has realized for a long time the great need of an efficient military organization always with it when operating away from the continental limits of the United States, or its bases, along the eastern or the western shores, in the time of war or grave danger, greater than the number of marines the ships ordinarily carry. The Navy proposes to use this military force for the purpose of protecting its advance bases near the seat of operations, or to seize, hold, or destroy such bases as may be held by an enemy within the zone of operations of the fleet. This important work has been assigned to the Marine Corps.

The advent of the advance base work for the marines caused a concentration of forces at several of the large naval bases in the United States and this concentration movement resulted in the good effect of a permanent organization into company units with a numerical designation assigned each, and the companies were further organized into battalions, regiments, and one brigade with headquarters at Philadelphia, Pa.

On numerous occasions since the Spanish-American War, the Marines have been called into expeditionary duty in Central American countries and the West Indies for the protection of American lives and property, in cases where they have been endangered by the atrocities which are usually committed by forces in arms against members of all nationalities residing in these countries.

Until 1912, the marine expeditionary forces generally depended upon the rifle and the machine guns as their weapons for use in the field except in one instance in the Philippines one company was at one time in the possession of our obsolete Navy landing guns, and in China in 1900, a company used this type of gun in the engagements around Tientsin, until the entire lot of ammunition was expended, when their further use on this occasion was abandoned.

As a means of transportation for this artillery, the men used dragropes, and with the twenty-four rounds of ammunition carried on the field piece, it is apparent that it could not have operated at any distance from a railroad, and, therefore, could not have been considered a serious factor.

The assignment of the advance base work to the marines and the increased importance of the character of expeditionary duty required

of them, where on different occasions they have been sent miles into the heart of Central American countries and placed in positions where they were dependent upon their own resources has imposed a new condition upon them. The revolutionary forces, whose actions the Marines at any moment might have had occasion to dispute, had begun to obtain modern artillery and to utilize the services of foreigners to serve it. These conditions found the Marines in a position where they could no longer depend upon the rifle entirely, and in 1912 when an expedition was sent to Cuba as a consequence of the disturbed conditions in the Province of Oriente, one company was provided with two field pieces of Mark VII landing gun type, which had been recently adopted by the Navy Department.

The officers and men attached to this company had received very little, if any, instruction and training in the use of artillery, and the guns were never fired during this expedition. It is supposed that the moral effect their presence in the district produced was sufficient to keep the insurrectos at a distance. I was informed by the officer commanding that company that his district was much less frequented by insurrectos than any of the others.

In 1910, the Advance Base School was organized and located at New London, Conn. Its object was to give officers both practical and theoretical instruction in subjects which would enable them to carry on successfully the new work assigned them.

The study of field artillery was embraced in the course, and it included the study of field artillery drill regulations and the handbook on 3-inch gun material. During the first year no practical instruction was possible, as only the books were furnished. The same course was pursued in 1911, with a new class of officers, those of the previous year being assigned to other duty. The practical work for this year included several map problems, and one or two days in the calculation of firing data. Those students who were found qualified to solve one of these problems were considered quite proficient in artillery. More practical work would have been included in the course had it been possible to have secured the necessary in-instruments and field pieces. The ordinary mind does not retain dry book rules and descriptions of instruments sufficiently long to be of much practical value, as will be seen later on.

In August, 1912, a regiment was hastily assembled at Philadelphia, Pa., and embarked for duty in Nicaragua. As I had completed

the course in artillery, and had succeeded after much tedious painstaking work in solving a few problems in firing data. I was assigned to the command of the company with the field pieces. Neither of the two junior officers of this company had ever used a field piece, and none of the men had any knowledge of guns. With these inexperienced officers and men, the usual battery instruments, and 200 rounds of ammunition. I found it a difficult problem indeed, to recall a sufficient amount of my book knowledge and in a few days produce a practical fighting unit.

From the date of embarkation on this expedition. August 22, until October 3, 1912, when the defenses of La Baranca and Coyotepe were bombarded, assaulted and captured, there was scarcely any opportunity offered to train the company to serve modern field pieces efficiently. My hastily organized company was constantly being split up for guard details, and previous to the bombardment, not a single drill was held where each man was taught his individual duty which he might have in action in this machine. No one in the company had ever fired a shrapnel and were very naturally disappointed to find that their action was not as prescribed in the regulations strictly, and were much at sea for a while what to do when shell after shell was fired and lost.

Coyotepe and La Baranca, two positions which commanded the city of Masaya were considered by the Nicaraguenses impregnable, and had never been captured. The railroad from Managua to Granada ran between these two hills, and Masaya lay on the side toward Granada. General Zeladon, who commanded all the rebel forces in possession of these hills and the city of Masaya, had his headquarters on Coyotepe. The latter hill was rather precipitous and difficult to climb. Barbed wire entanglements had been provided and the position fairly well intrenched. The character of trench was generally deep and narrow, and partially provided with traverses for protection against flank fire. The top of the hill contained a trench which extended completely around it. The wire entanglements were located below the lower line of trenches.

The upper trench or parapet was occupied by a portion of the infantry, several machine guns, one 3-inch gun with a range of 8,000 meters, and several 1-pounders which were very obsolete.

La Baranca contained two redoubts for infantry, and with two 3-inch field pieces, one redoubt for infantry, and one machine gun, with a series of small rifle pits very poorly constructed for infantry.

A ridge extending from Coyotepe toward La Baranca, also commanding the railroad, was defended by two more 1-pounders, one machine gun and infantry. There were no entanglements in front of this ridge.

The tense situation in Granada, 25 miles south of Masaya, demanded the presence of Marines, so accordingly Maj. Butler's battalion was dispatched there. When his train reached a point about 3,000 yards from Coyotepe, between the Federal and rebel lines, it was fired upon by the artillery from Coyotepe. It was then decided to force a passage. Two more battalions were brought up from Managua, and the company of Artillery from Leon.

The two guns which had been attached to Maj. Butler's battalion were added to my company. All the guns were brought up on the train within 2 miles of the position selected for the artillery, there disembarked from the train, ox teams hired from the federal forces, and then they were hauled into position about 2,600 yards from Coyotepe and 1,800 yards from La Baranca.

When all the details for the attack had been completed, word was sent to Gen. Zeladon that his position would be bombarded unless our troops were permitted to pass on to Granada unmolested. After considering our numerical superiority, and after much customary discussion characteristic of all Latin-American people, he finally agreed not to molest the passage of American troops, nor to interfere with the operation of the railroad. Our troops then withdrew.

With respect to the railroad, the agreement was soon broken, and it became necessary to dislodge these rebel forces from the menacing position they were occupying. On the afternoon of October 2 our forces occupied the same positions they had previously occupied.

The bombardment was ordered to begin at 8 o'clock on the following morning, provided the rebel forces had not in the meantime complied with our demands.

The method of fire employed for adjustment was by piece with timed fire. I was not long in discovering that this method was quite impracticable, with a range table for the time of flight which I had, with the assistance of several officers, worked out from Alger's Ballistics on the way down on board the transport; with only an improvised fuse punch, which was imperfect in its results; and with only book knowledge to guide me in making observations and applying corrections. Direction was easily obtained, but the imperfect action of the fuses so completely confused me that this

method was very shortly abandoned, and an effort made to adjust by percussion. This method also proved to be a failure as the shots going over the position could not be observed and those falling short were lost in the high grass and bushes in the proximity of the near side of the target. There was not sufficient ammunition to expend more in these fruitless attempts to adjust the fire on the narrow barren strip of earth on top of Coyotepe where the trenches were located, by this method. Percussion effect of these shells for observation was found to be small, and an examination of the ground after the engagement showed that some of the shells had not functioned on impact, only burying themselves in the ground. At this hour, the sun was directly in our eyes, and the side of the target towards us was very dark, which two features contributed further to the difficulty of adjustment.

La Baranca being a barren hill, observation by percussion was possible. A few shots directed at the defenses here caused the occupants to desert their positions, and it appeared that they never again returned. The field pieces and machine guns were the principal targets, but our shells only tore up their earth-work defenses, and frightened the occupants away.

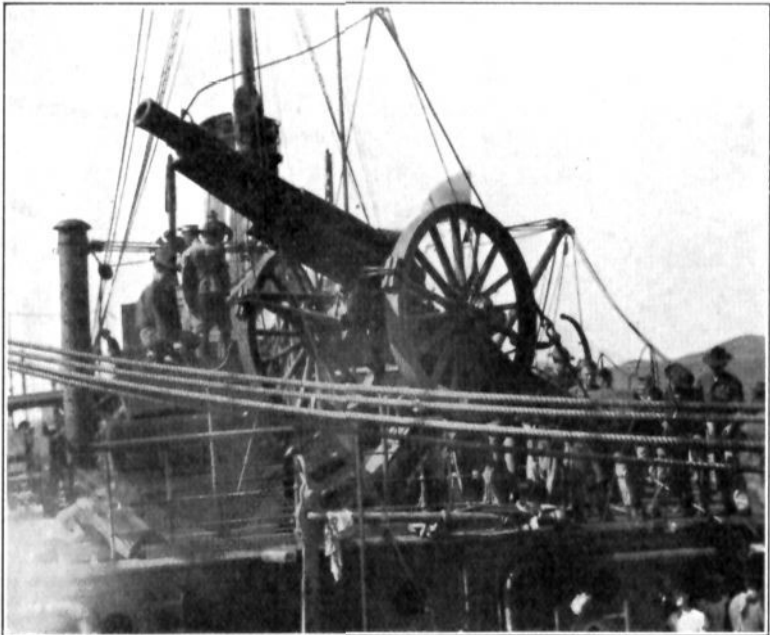
Coyotepe was again bombarded during the afternoon, and fire adjusted on the trenches by percussion. This was made possible by the target being lighted up by a change of position of the sun and the experience gained during the day. The battery position enabled the fire to enfilade the principal trench and some effect was obtained by percussion fire.

In the forenoon, the rebels moved about their positions quite leisurely without any apparent fear of our fire, but during the afternoon they stuck closely to their trenches, and only moved when compelled to do so by the effect of the fire upon their trenches. There was considerable confusion amongst them on several occasions, in their endeavor to seek cover elsewhere, when their main trench was enfiladed. They were again surprised to find that their new position some 50 yards away from the main trench was quite as dangerous. The majority of the rebels then sought cover on the reverse slope of the hill and it was reported that many of them returned to Masaya.

Both direct and indirect laying were used, but much better results were obtained when using indirect laying even when the target could be seen plainly. The difficulty of pointing out to each gunner



MARINES HAULING GUNS UP STEEP INCLINE INTO POSITION, CULEBRA, PORTO RICO.



HOISTING 4.7 INCH GUN FROM HOLD OF TRANSPORT WITH SPECIAL LOADING GEAR.

the exact point where his aim should rest on the lines of trenches occupied by the rebels, and keeping him on that same point in subsequent firing for close adjustment was realized practically when after firing a number of shots dispersion in both range and direction added to the already long list of difficulties. In some parts of the line for a distance of 50 yards or more, the trenches would present such a sameness of appearance that it was found not only a difficult task, but a waste of considerable time to indicate to the gunners their point of aim.

During the night of the third of October, shots were fired at intervals with previously obtained data at the trenches on Coyotepe, while the infantry was moving into position for the assault on the early morning of the next day. A smothered lantern hung close in rear of the gun, served as an aiming point. The bursting shell illuminates the targets very little at night.

Owing to the faulty ammunition, poor implements for handling it, and the absence of reliable communication between the infantry and the artillery, the infantry received no support from the artillery.

Had it been possible for the artillery to have cooperated with the infantry on this occasion, it is believed that nearly all opposition directed against our forces could have been forestalled by shrapnel used with either time or percussion fire. When the infantry assault began, although it was too dark to distinguish between friend and enemy, I could plainly see the rebels rising from the trenches they had abandoned the previous day, and had again occupied during the night, to fire their rifles and machine guns at our troops as they advanced toward the position. It occurs to me that in such a position as this, it is the artilleryman's duty to act without orders, but in this particular instance faulty ammunition and the absence of reliable communication would have made it a very hazardous undertaking.

Even in this little engagement where we were only a couple of thousand yards distant from the enemy, an experienced artillery officer near the infantry in direct communication with the artillery would not only have been helpful in aiding observation, but would have been invaluable in keeping the artillery informed of the location of our troops, and informing the artillery when its own fire was becoming dangerous to our troops. One company advanced up a ravine and they could not possibly have been seen by me until they had arrived within a very few yards of the enemy's position.



DISCHARGING FIELD GUNS FROM TRANSPORT INTO NAVY CUTTERS.



4.7 INCH GUN MIRED ON ROAD IN CULEBRA, PORTO RICO.

It was remarkable the way the occupants of Coyotepe fought to the very end in face of certain death.

During the assault, a small field piece which was concealed in rear of the slope running from Coyotepe to La Baranca was run up into position, and opened up a rapid fire at the hospital train approaching the position it was ordered to take to receive the wounded. At a range of 1,700 yards with previously obtained data, two shots were sufficient to cause its gunners to abandon it. But for this timely action the hospital train might have suffered considerable damage or been destroyed.

At the capture of Leon, the artillery did not come into the action which resulted upon the occupation of the city. It occupied a position, however, for the purpose of bombarding the fort outside the city, and to watch church towers where it was known snipers were located. No action resulted as the garrison surrendered to our forces the following morning after the city surrendered.

In this campaign, the actions which occurred were on or near railroads, and the artillery was loaded on flat cars for transportation for great distances. When it became necessary to occupy a position too distant from the point of disembarkation from the train to the place to be occupied for the attack for the guns to be hauled into position by man-power, yokes of oxen were procured and the yoke lashed to the limber pole. Two yoke were found to be sufficient to haul our gun and limber weighing 5,500 pounds, but at a very slow pace. If it had ever become necessary to maneuver for any purpose it would have been quite impossible.

This little action taught us its lesson. It showed very clearly that Marines should have mobile and well-trained artillery to accompany them on their expeditionary work; that they must be provided with efficient material; and that its officers and men must be thoroughly trained in its use to obtain its maximum effect.

The causes which contributed mainly to the failure of the artillery to do fully what should have been required of it in this action can be attributed to three things: viz., inexperience of officers and men in the use of artillery material, faulty ammunition and fuses, and lack of cooperation between the infantry and artillery. The causes have since been largely eliminated by the training of officers and men in the use of artillery material, the manufacture by the Navy Department of improved shrapnel with an excellent fuse, and provision for a reliable means of communication.

In February, 1913, the company which is now numerically designated as the 1st Company was regularly organized as an Artillery company. Shortly afterward it embarked with the 1st Brigade of Marines sent to Guantanamo, Cuba, on account of the disturbed conditions existing in Mexico. This company was equipped with four Mark VII landing guns, four limbers, each carrying seventy-two rounds of ammunition and a fire control equipment practically the same as now carried by a light field battery of the Army.

While in Guantanamo, systematic training was carried on without interruption for a period of six months, so far as the officers were enabled to do so with their limited knowledge of this subject. Target practice was conducted and problems solved, various ranges being used. The unreliability of old 15-second fuses of unknown date of manufacture rendered adjustment by time fire impossible. The percussion method was used entirely, but, nevertheless, these problems were valuable in the lessons they taught in fire discipline, fire control and observation of percussion fire.

Upon the return of the Marines from Cuba, during the summer of 1913, six Marine officers were detailed for duty and instruction at the Artillery camp of instruction under Maj. Summerall at Tobyhanna, Pa., where they were given the same course of instruction as had been given to regular and militia officers of the Field Artillery arm. The Navy Department on this occasion furnished 100 rounds of ammunition, and each officer was allowed to fire several problems. The attention given the Marine officers at this camp by Maj. Summerall and the officers attached to his command has proven of very great benefit to our service and the hospitality extended to us will be long remembered.

In the fall of this same year another company was organized into an artillery unit, and began training as such with the same equipment as had been furnished the other company.

Both of these companies took part in the Advance Base exercises conducted in Culebra, Porto Rico, during the winter of 1914. One company was assigned to the mobile defense regiment and the other one to the fixed defense regiment.

These exercises unquestionably showed the need of a battalion organization for the artillery, not only for purposes of conducting uniformity of training and better administration, but for its proper use in an advance base organization.

In cases which should be decided only by the brigade commander

one regimental commander might easily deny the other the use of his artillery where these units are attached to separate regiments. Each regimental commander might have felt the need of his own artillery within his own command, and justly have refused the other commander's request, even though the latter's need were more pressing.

Prior to the exercises in Culebra an adjustable harness had been designed for the use of my company for the purpose of testing it out with native animals, and further for determining their usefulness as draft animals for artillery. The collar was patterned after that used by the fire department of Philadelphia. It could be adjusted in height only. The ponies with narrow necks suffered considerably when in draft by the collar sliding and rubbing across the shoulders when they were advanced in walking, which soon resulted in sore shoulders and sore necks where the collar rested on the neck. This latter fault was partly due to the unevenly balanced limber pole, heavy limber, improper adjustment of back straps, which had a tendency to pull too much downward on top of the neck.

The chief fault lay in subjecting the animals to hard draft as soon as received and harnessed. They should have been given training and exercises which would have gradually hardened and strengthened them before being placed in hard draft. They arrived too late for this to have been done. They did not understand how to pull, and instead of attempting to move the load by a steady, hard pull, they surged forward into the collars and wounded themselves. After a short period they were so badly used up that they were unfit for further use as draft animals.

Out of about thirty ponies, stallions and mares, I found only about half a dozen that proved worth while as draft animals, and these were too small and light to stand service.

These animals are unused to draft, small, and in poor condition generally, and are raised on grass. I believe it would take months of training in proper hands by experienced men to put them in condition so that they might be depended upon as draft animals for field artillery. At the most critical times in the maneuvers they failed to get the guns where they were needed in time for the action.

The third artillery company was organized by the Marine brigade commander after the occupation of Vera Cruz, Mexico, in April, 1914. The three companies were then regularly organized into an

artillery battalion. Upon the occupation of Vera Cruz, Mexico, one company seized a sufficient number of mules and horses for draft animals, and officer's and enlisted men's mounts. The other two companies were subsequently provided with small native mules purchased locally, designated by the troops in Vera Cruz as the "Rabbit Batteries." While this means of draft was inadequate, it was far superior to man draft. For the defense of Vera Cruz, it might be said that the guns could, at least, be moved in case it had become necessary to have used them in action. When Vera Cruz was evacuated the mules were returned to the Army.

Two 4.7-inch guns were obtained from the Army for experimental purposes with the Advance Base Brigade exercises. These tests showed that the present design of carriage is unsatisfactory for use in this work where the gun may be required to follow a rapidly moving vessel. Further action with regard to the adoption of this particular type of gun, I believe has been suspended pending further experiments to determine its suitability for this work. It is believed however, that the split trail feature in the carriage adapted to this gun would make it very satisfactory in this work especially in the use that might be made of it against unarmored vessels, against transports attempting to discharge troops into small boats for landing purposes, causing them to be discharged at a great distance from shore, thereby endangering them, while approaching a landing, to a continuous shrapnel fire, assisting in the defense of mine fields, and for use in the defense of the landside.

It will be seen from the nature of duties the Marines are required to perform that they may be called into such service as will require them to operate over rough mountainous countries, where it will often be impossible to even cut roads for light or heavy artillery. At other times they may operate where draft is possible. It would seem then that at least three types of guns should be provided for marine field artillery and should be apportioned as follows: One battalion of 3-inch mountain howitzers for advance base and expeditionary duty, one battalion of light field guns transported by motors for advance base work, and one battalion of 4.7-inch guns of the splitrail type, transported by motors for advance base work.

The most serious proposition confronting the Marines in the operation of their field artillery is that of transportation for their field guns and men to operate them.

The large amount of oversea work required of the Marines and

the possibility of lying at anchor for weeks at a time with the fleet, awaiting developments renders the question of carrying a large number of animals almost an impossibility.

Whether it be on expeditionary duty, advance base work, with the fleet, or duty with the Army, the man is not the agency to be called upon to haul guns and ammunition on the march or field of battle, except on rare occasions and for short distances only, where other means have been destroyed or the presence of such means would mean sudden destruction. If our artillery is to be used at all, it must not be forgotten that one of its chief essentials is for it to reach a position from which an effective fire can be brought to bear upon the enemy, whether on the offensive or defensive, and we must be provided with sufficient ammunition to fight a battle and the men must be in proper condition to serve the guns. One artillery position will not ordinarily be sufficient to meet the changes occurring on a battle field, therefore, mobility will be an essential to meet this requirement. The commander will need artillery to push his offensive or check the enemy's offensive movement, and in this connection, time is an all-important element of consideration. No effort should be spared to meet this requirement for our artillery.

If marine artillery is to possess the necessary factor of mobility to meet all of the aforementioned requirements, it must depend almost solely on some form of motor transportation or upon the unsatisfactory and uncertain means of securing local animals wherever the seat of operations should be. It is a doubt clouded with a good deal of uncertainty whether ponies or small mules usually found in the Central American countries and the West Indies could ever be made to meet the requirements of draft animals for field artillery. It would seem, then, that even if the motor cannot do all that draft animals can be made to do, the sacrifice of the animal for the motor would appear to be wise.

The Marine Corps has had under consideration two types of motor tractors for use with its field artillery. These types have recently been tested before a board of marine officers, and it is the intention of the headquarters of the Marine Corps to purchase two motor tractors of one of these types for further experimental use with the Artillery Battalion at Annapolis, Md.

At present the Marine Artillery might be said to be in its infancy. Its material is incomplete; its transportation facilities are inadequate, or better said, nil; its officers and men have had little training in

firing in the practical use of artillery matériel, and in use of special details.

It has been proposed to provide a certain number of animals at Annapolis for the training of special details, and to teach men how to care for and train animals for mounts and draft purposes, in case conditions similar to those met with in Culebra and Mexico are met with in the future. Our experiences gained heretofore on these expeditions and maneuvers certainly show the wisdom of such a provision in order that the best use may be made of the material seized and our men properly trained.

The course at the Artillery School at the Marine Barracks, Naval Academy, Annapolis, Md., is primarily a school of research. An earnest effort is being put forth to remedy the seemingly apparent defects in organization, material and training. With the able support of the pioneers in artillery in the Army, which support we have already felt, we hope to build up a force which will be dependable and of consequence in any upon which it may be placed.

BATTERY COMMANDER'S TELESCOPE, MODEL OF 1913.

(SEE FIGS 1 AND 2)

The principal parts of the instrument are the tripod, leveling mechanism, azimuth mechanism, elevating mechanism, angle of site mechanism, and telescopes.

The tripod consists principally of the tripod head, upper sections, clamps, and lower sections. The upper sections are attached to the tripod head and are braced by the leg separators. The lower sections are of tubing and slide freely through the base of the upper sections. By means of clamps they can be locked in any position to suit the height of the observer.

The leveling mechanism consists principally of the vertical spindle (lower), vertical spindle bushing, friction washer, and vertical spindle nuts. The vertical spindle is ball shaped at its lower end and is seated in a socket formed in the vertical spindle bushing. This ball-and-socket construction permits the instrument to be quickly leveled and locked in position by the vertical spindle-clamping lever. The friction washer permits an adjustment of the vertical spindle nuts to give sufficient friction on the ball to prevent the instrument from falling over when the vertical spindle-clamping screw is released.

The vertical spindle-clamping screw prevents movement in azimuth of the instrument when leveling, and the spindle-socket cover protects the ball-and-socket joint from dust and dirt.

The azimuth mechanism consists of the azimuth-adjusting device and the azimuth device.

The azimuth-adjusting device consists principally of the azimuth-adjusting worm, azimuth worm wheel, azimuth-adjusting worm case, azimuth clamp support, azimuth clamp shaft, azimuth clamp shaft knob, and azimuth-adjusting worm knob. Pinned to the vertical spindle (lower) just above the ball is the azimuth clamp support upon which the instrument rotates when released by the azimuth clamp shaft knob. When thus released, the line of sight may be brought rapidly to approximately the desired position and locked. A finer adjustment can be made by turning the azimuth-adjusting worm knob. The instrument level is seated in the azimuth-adjusting

worm case. Backlash between the azimuth-adjusting worm and the azimuth worm wheel is removed by means of the azimuth plunger spring and plunger.

The azimuth device consists principally of the azimuth worm case, azimuth worm, azimuth worm bushing, azimuth worm wheel, azimuth worm knob, and azimuth micrometer. The azimuth worm is held in contact with the adjusting worm wheel by means of the bushing spring and the eccentric azimuth worm bushing and is so arranged that it may be disengaged from the azimuth wheel. When thus disengaged, the line of sight may be turned by hand and the instrument rapidly oriented to approximately the desired position, where the azimuth worm can be thrown into mesh and the liner adjustment made by turning the azimuth worm knob. The azimuth scale soldered to the azimuth worm wheel, is graduated into sixty-four equal divisions, each division corresponding to 100 mils. An index engraved on a German silver strip is set into the rear side of the azimuth worm case to register with the graduations on the azimuth scale. The perimeter of the azimuth micrometer is graduated into 100 equal divisions, each division corresponding to 1 mil. One complete revolution of the azimuth micrometer equals 100 mils, or one division on the azimuth scale. After adjusting the azimuth micrometer to the proper position, it may be locked by the micrometer lock nut.

Both the azimuth-adjusting worm and the azimuth worm mesh into azimuth worm wheel.

The azimuth mechanism is attached to the upper end of the vertical spindle and retained by the azimuth mechanism retaining screws.

The azimuth mechanism may be removed from the instrument by releasing the locking plunger in the elevation worm wheel, lifting off the telescopes, releasing the azimuth clamp-shaft knob, and removing the azimuth mechanism retaining screw. The azimuth mechanism can then be removed and replaced by the azimuth mechanism on the vertical spindle (lower).

The elevating mechanism consists principally of the elevation worm case, elevation worm wheel, elevation worm, elevation worm bushing, and elevation worm knob. The elevation worm seated in the elevation worm case meshes with and travels about the elevation worm wheel carrying with it the telescopes. The movement of the elevation worm wheel is not less than 18° in elevation and 18° in

depression. Backlash between the elevation worm and the elevation worm wheel may be removed by adjusting the eccentric elevation worm bushing. The elevation worm bushing is locked, after adjusting, by the bushing clamp plug.

The angle of site mechanism consists principally of the angle of site level vial holder, angle of side worm, angle of site level vial, angle of site scale, and angle of site micrometer. The angle of site level vial holder meshes with and is rotated by the angle of site worm, carrying with it the angle of site level vial. The angle of site scale has three graduations, 100 mils apart, on each side of the center graduation, and numbered from 0 to 6. "3" corresponding to the reading for zero angle of site. An index is engraved on the angle of site level vial holder opposite the "3" or normal graduation of the angle of site scale. The perimeter of the angle of site micrometer is graduated into 100 equal divisions, each division corresponding to 1 mil. One complete revolution of the angle of site micrometer equals 100 mils, or one graduation on the angle of site scale. An index engraved on a German silver strip registers with the graduation on the angle of site micrometer. The movement of the angle of site worm wheel is not less than 18° in elevation and 18° in depression. Backlash between the angle of site worm and the angle of site worm wheel is removed by means of the elevation plunger spring and plunger.

Telescopes consist principally of the eyepieces, tube bases, tubes, objective-prism holders and optical systems. The lower ends of the tube bases are attached to and rotate about the elevation worm bushing and can be locked to suit any desired eye distance by the friction clamp knob. A set of friction disks, contained in the friction-disk sleeve, is so adjusted by the friction-disk retaining nuts as to give sufficient friction on the tube bases as to prevent the telescopes from falling when the friction clamp knob is released. The eye-distance index attached to the right tube base registers with the eye-distance scale, showing the eye distance of the eyepieces in either vertical or horizontal positions of the telescopes. In either position the minimum reading is 60 millimeters, and the maximum reading is 70 millimeters. Both eyepieces are provided with triple screw threads for focusing. A diopter scale with graduations numbered in opposite direction from +0 to 5 and -0 to 5 is provided for quick adjustment when the instrument is in use by more than one person. A reticule located in the right eyepiece can be rotated by means of the

reticule-adjusting ring so as to keep the etched lines on the reticule in their correct position, whether the telescopes are in use in horizontal or vertical positions. The steel telescope tubes are screwed to the projections on top of the tub bases. Two diaphragms are mounted on the inside of the telescope tube to cut out stray rays of light. The objective cells are so located in the upper ends of the telescope tubes that the objectives are in their proper position. To the upper end of the telescope tubes are screwed the objective-prism holders which act as housings for the objective prisms. Adjustment in three directions is provided to properly align the objective prisms. The objective-prism shields seated in the front end of the objective-prism holders are used to protect the objective prisms. The objective sun shades are provided and may be sprung into their seats in the front of the objective-prism holders.

Leather covers attached to the instrument by leather straps are provided for both the objective and eye ends of the telescopes for protection when the instrument is not in use.

The optical systems consist of the objective prisms, objectives, small erecting prisms, large erecting prisms, and simple astronomical eyepieces.

The optical characteristics of the instrument are as follows:

Power, $10 \pm 2\frac{1}{2}$ per cent.

Field of view, $4^{\circ}15'$ minimum.

Focal length of the objectives, 11.55 ± 0.05 inches.

The field is flat, free from chromatic and spherical aberration, coma, and distortion.

The instrument is adjusted by means of a collimating telescope so as to be free from parallax when the diopter scale reads 0.

The lenses and prisms are made of the best grade of optical glass, free from all striae, bubbles, cloudiness, checks, strains, or other imperfections which would affect the optical characteristics of the sight.

The lenses and prisms are firmly secured to the metal parts in such a manner as to permit of easy removal for cleaning and correct replacement.

The instrument is provided with an optical glass reticule, as shown on the drawings. The cross lines etched upon the glass are 0.001 inch wide.

Before being accepted by the Ordnance Department, each instrument is exposed five minutes to artificial rain, the water to have about the same temperature as the room in which the test is made.

The instrument will be stored in the same room with the water for one hour prior to the test, so that the temperature of the instrument will be approximately the same as the temperature of the water. At the conclusion of the test no water must have penetrated into the interior of the instrument.

As soon as Model 1913 instruments are ready for issue it is proposed to issue them in place of the present battery commander's telescope.

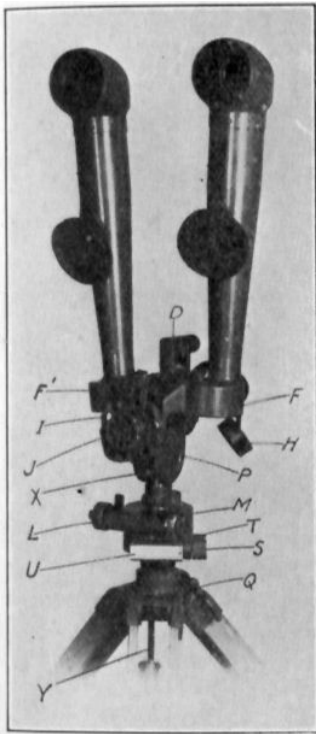


FIG. 1

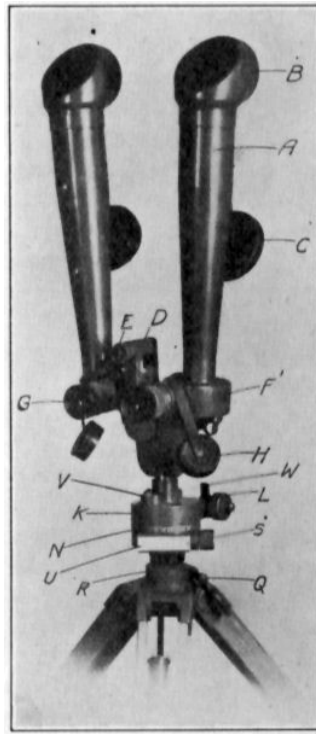


FIG. 2

- A Telescope tube.
- B Objective prism holder.
- C Objective prism cap.
- D Angle of site mechanism.
- E Angle of site micrometer knob.
- F Tube Base (Left).
- F' Tube base (Right).
- G Eye piece.
- H Eye piece cap.
- I Friction clamp knob.
- J Elevating worm knob.
- K Deflection mechanism.
- L Azimuth worm knob.

- M Azimuth micrometer.
- N Azimuth worm wheel.
- P Elevating worm case.
- Q Vertical spindle clamping lever.
- R Ball joint.
- S Azimuth adjusting worm knob.
- T Azimuth clamping knob.
- U Tabulating strip.
- V Tripod level.
- W Azimuth worm lever.
- X Locking plunger.
- Y Tripod leg locking clamp.

THE EMPLOYMENT OF ARTILLERY IN THE BALKAN AND IN THE PRESENT EUROPEAN WAR.

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Lecture delivered at School of Fire for Field Artillery, Spring Term, 1915.

PART I—BALKAN WAR.

In the Balkan War for the first time two armies faced each other armed with modern quick-firing artillery. The field artillery played a very important part, much more so than it would in all probability in another war of as brief duration. This was because of the marked superiority of the artillery of the Allied Balkan States, and the ease with which on almost all occasions, it bested the opposing artillery, thus being able to turn at once to the unmolested support of its own infantry.

The success of the Allied States and particularly their incontestable superiority in artillery fire gave rise to a bitter dispute which lasted for some time between the French and Germans as to the relative merits of their artillery. This was because the Allied States, with the exception of Montenegro, which was supplied with a Krupp 80-millimeter field gun, were all equipped with the Schneider field gun, of a type very similar to that used by the French Army, whereas the Turks were provided with a 75-millimeter Krupp. Ballistically there is little appreciable difference. The weight of projectile is about the same, the Turk gun about 100 pounds lighter than that of the Allies. There were several points about the French model, however, undoubtedly in its favor. These may be briefly enumerated—recoil in the direction of the trail spade, making for stability, independent sighting apparatus, a graduated corrector scale. These were lacking in the Krupp. But these defects were not sufficient to account for the tremendous superiority of the Allied armies in the artillery arm. Rather must they be ascribed to superior training, organization, and *esprit de corps*. The Allies had had their guns for some six years; drill in occupation of positions, in marching, and in actual firing had been a part of their training, advantages of which the Turks had had little or none. The result when it came to actual test on the field was inevitable.

The operation of the artillery of the various combatants in the field will be considered first, and separately from its use in siege operations, which will be taken up later.

The Turks, trained in the old school and lacking in the latest mechanical improvements in equipment, seem either to have been ignorant of indirect fire, or else to have deliberately ignored it. Rarely or never did they place their guns in masked positions for indirect fire, although in numberless cases, positions affording flash defilade could easily have been obtained. Often, however, five guns of the battery were concealed, the other, evidently used as a directing piece, being left in the open or placed so as to fire directly over the crest. This, of course, almost always led to its destruction, although the other guns, at some distance to the right or left as often as not escaped.

The Turks, however, were not ignorant of the principles of entrenchment. The guns, as well as the infantry, always dug themselves in, and trenches in rear of the guns afforded cover for the cannoners when hostile shrapnel fire became too hot. At Tchataldja, for instance, the Turks dug such large communication trenches that guns could be dragged along them.

In the occupation of positions, the Turks seem to have been almost wholly untrained, likewise of withdrawal. It followed naturally that, once established in a position and engaged, they were very unwilling to attempt to leave, even though tactical considerations demanded it. Thus, both at Kumanovo and at Monastir, batteries were abandoned which had suffered little or not at all from hostile fire.

The Turks apparently regarded the artillery duel as useless, engaging in it only when it was forced upon them. At times this tendency cost them dear. Thus, at Kumanovo, they occupied advanced positions in the open in order to fire upon the Servian infantry, disregarding their artillery. But before the infantry attacked, their artillery engaged the Turkish batteries and put them completely out of commission, after which the Servians could concentrate two arms upon the Turkish infantry. At Tchataldja, on the other hand, behind each of the advanced infantry positions, the Turks placed a battery or group of batteries, entrenched, with cover for the gunners. Because of the great range, the Balkan artillery was unable to reach these positions effectively, and their infantry attack was repulsed with great loss by the combined Turkish infantry and artillery fire. This, however, may be regarded as an isolated instance, as in the great majority of cases, those batteries pushed far to the front in direct fire positions were promptly silenced or knocked out.

The fact that of the 530 guns used by the Turks in the field, over 300 fell into the hands of the Allies is sufficient proof of this statement.

The lack of a corrector scale in the Krupp gun and the poor action of the fuses used militated materially against the effectiveness of Turkish artillery fire. All accounts agree that although the Turks always succeeded in adjusting for range, their bursts were so high that little effect was produced. The Allies' infantry frequently used intrenching spades and even mess plates as head protection against this high falling shrapnel fire. As for their artillery, its batteries in masked positions seem hardly to have been damaged by the Turkish fire. Throughout the entire campaign, for instance, only one Servian artillery officer was hit by a shrapnel bullet. In connection herewith, it should be stated that the Turks, like the Allies, were supplied only with common shrapnel and percussion shell, having no high explosive shrapnel, or time or delay-action shell.

In the Bulgarian Army, the proportion of rapid-fire guns to rifles was less than two to a thousand. This excludes the old type Krupp guns of the reserve, which seem not to have taken part in the actual field operations. This fact should be borne in mind in considering the results they accomplished.

The Bulgars had been thoroughly instructed in the use of masked positions, and always took them when possible, although they did not hesitate to move into the open to fire upon attacking infantry if the situation demanded. They usually preferred, when the terrain permitted, to place their batteries far to the rear of the covering crests. As their system of telephone communication was not all that it should have been, this resulted often in slowing up the fire considerably.

The Bulgarians believed that a battery seen within gun range was a battery lost. Their anxiety to occupy positions under cover led often to a failure to move up close enough to be able to fire at effective ranges. The poor quality of their horses and the fact that they had been provided in time of peace with less than half the number required per battery perhaps contributed to this timidity. This lack of skilled drivers not only caused their failure to move forward by daylight, but at night as well. So we find them firing at 5,000 to 6,000 meters, when by a little more boldness they might have moved up to a range around 3,000 meters and been able to

produce better results. Thus at Tchataldja they engaged the Turkish batteries at a range of 6,200 to 6,400 yards. Due to the irregular and high bursts at such long range, they accomplished nothing, and their infantry, when it attacked, was mowed down. The effects of the Bulgarian artillery fire seem to have been of neutralization or immobilization rather than actual killing effect. This was partly due to the fact that the Turks nearly always entrenched as soon as they came under artillery fire. That it was essential to effect this neutralization, however, before the infantry could hope to attack with success, and to maintain it during the attack, was demonstrated repeatedly. The necessity of close cooperation between the infantry and artillery is at once apparent. This was obtained more often by the initiative of junior officers than by any prearranged scheme on the part of the higher commanders. Various expedients were adopted, such as the burning of straw at certain points to mark the progress of the attack, the display of flags by day and lights at night. That the lack of any general scheme to achieve this close connection between the two arms more than once caused severe losses in the infantry ranks from the fire of their own guns proves the need of securing it.

The three groups of artillery with the Bulgarian division were often assigned one to each of the three infantry brigades, and this subdivision was frequently carried down to such an extent as to split up batteries and have single pieces firing at separate targets. Thus there was no reserve artillery under the control of the chief commander to be massed at a critical moment against some one decisive point. In the battles in Thrace, it was the impetuous attack of the Bulgarian infantry which was the leading factor, rather than any overwhelming artillery fire concentrated on the point of attack.

The proportion of guns to rifles for the Servians was somewhat higher than with the Bulgars, about two to a thousand. The Servian artillery had been thoroughly trained in indirect fire, and used masked positions whenever possible, although it was willing when necessary to come into the open. It had been able in time of peace to train twice as many drivers per battery as the Bulgars, and was consequently more skilled in the occupation of positions. Upon several occasions, when the situation demanded it, they not only took unconcealed positions, but actually moved to a closer one during the course of the battle. They frequently moved their guns forward

by night, dragging them by ropes up and down steep slopes for distances of 2,000 yards or more. During the operations in Macedonia, a country of precipitous slopes, their batteries were very near the covering crests, the battery commanders frequently using observation ladders. Their fire, as a result, was more rapid than that of the Bulgarians.

Due to the fact that they fought at closer ranges, the fire of the Servians was more effective than that of the Bulgarian, the height of burst being more accurately regulated. Both at Kumanovo and at Monastir, they were able to silence the Turkish batteries soon after they were located. By trial shots against certain points in which the presence of the enemy was expected, they obtained ranges beforehand, and were able to get effect soon after targets appeared.

The cooperation of the Servian artillery and the infantry was closer than in any other of the Allied armies. As a result, their infantry losses from their own artillery fire were much less. Their mountain artillery was always used to accompany the infantry and give its close support in the attack. In the hilly terrain of Macedonia it was able to go many places which the light guns could not have reached at all. At Monastir, at one point where the range proved too great for the mountain artillery, a battery of field guns was pulled up to a crest which afforded room for no more. A regiment of infantry was used to bring up ammunition from the limbers and caissons below, and the battery so placed employed sweeping fire of sufficient rapidity to accomplish what was desired.

The Servians were much more inclined to keep their artillery massed and under the control of the chief commander than were the Bulgarians. Groups could be shifted from one point of the line to the other as desired, and a powerful mass fire used when necessary to open up a breach for the infantry attack. This was followed up, when successful, by the advance of the artillery to open upon the hostile retreating infantry and to secure the position gained against any counter-attack.

We will now consider for a moment the employment of artillery at the siege of Adrianople. We are passing over the Greek artillery, because of the relatively small part it played in the war, and because of the lack of sufficient data from competent observers. Briefly, it may be said that it had been trained in the use of indirect fire, and employed it usually except for several cases in which it was not

permitted by the terrain. The Greek handling of artillery was both bold and skillful and generally produced important effect.

Before Adrianople, political considerations were responsible for the decision of the Allies to hasten the capture of the city when it became evident that depending upon famine to force the surrender was going to take too long. The Turks had at their disposal a total of 612 guns, 228 of which were 87-millimeter rapid-fire field guns, with horses available for transportation. The fortifications were old, without cement or overhead cover. The principal line of defense was weak, thus making it desirable, because of the great number of guns on hand, to send as many as possible to the outer defenses. But this was not done, nor was anything near the number of guns brought into action that was needed, in spite of the fact that the supply of ammunition was plentiful. The line was divided into sectors, each with its own commanding officer. In the northwest sector, the batteries were echeloned, and certain ones assigned the duty of guarding the flanks. But in the east sector, the batteries were in line, making it necessary to run the guns out into the open if the flank was endangered.

The service of information of the Turks was very poor. The Bulgarians had much better maps of the country about Adrianople than did the Turks, who seem to have been in entire ignorance of the terrain, the number and kinds of guns possessed by their opponents, and the quarter in which they had been massed for the main attack. The Turks possessed no aeroplanes—they had one observation balloon, which made no flights during the siege, and several searchlights, the operation of which was very poor.

The Allies had a total of 168 field guns, of which seventy-two were 75-millimeter rapid-fire guns, twenty-eight were 120-millimeter rapid-fire guns, and twenty were rapid-fire heavy howitzers. Of these the heavy guns were used in permanent emplacements, the light forming the mobile reserve. It early became evident that a general frontal attack could not succeed, and a salient in the northeast sector was chosen as a point against which to mass the artillery for a sudden attack. In spite of the fact that it was necessary to transport the guns over 50 miles of rough country without roads, this was done without the Turks learning about it at all.

The service of information of the Allies was excellent. They possessed maps showing correctly the Turkish emplacements, and

were able beforehand to verify their ranges by trial shots from single guns. Their elaborate telegraph system worked well and during the attack the chief commander was in communication with his artillery in each sector and with his attacking infantry. One observer behind the sector attacked kept the Allies' commander informed as to its progress.

The Allies took all precautions for protection in constructing emplacements for their guns. Timbers were even brought from Sofia for supports of the splinter-proof head shelters, and these were so well built that during the final attack the batteries therein, though under constant and heavy fire, lost only three men killed, this from one lucky percussion burst. Until the day of the final assault, the guns before the salient in the northeast sector remained silent, the batteries of the other sectors keeping up a steady fire which until the last kept the Turks in ignorance of the point for the main attack. When the time came, these concealed batteries opened up a cross and converging fire on the salient, the batteries there, except for those of one fort, were soon silenced. This fire was such that the Turks were unable to send up additional batteries as reinforcements. The night attack made by the infantry was accompanied by two groups of 75-millimeter batteries to within 2,200 yards of the Turkish line. One of these groups suffered severely, but its commander formed one battery from such sections as remained intact and moved up to within 400 yards of the fort which was the objective of the infantry. By the oblique fire which it delivered, it assisted materially in its capture.

As a result of the operations of the Balkan war, several conclusions as to the employment of artillery seem to be warranted, and are, in fact, asserted by the officers of the various contending armies: that well adjusted artillery fire can stop the fire of a battery, whether shielded or not, that in a duel between a concealed battery and one in the open the concealed battery will win, that a battery once seen or a battery caught in motion is a battery lost, that a duel between two concealed batteries is useless, that a battery firing at a long range, say 6,000 yards, against another may cause inconvenience but cannot reasonably hope to put it out of action. With a shell of greater explosive effect than the common shell, however, this statement might not apply. The frequent movement of pieces forward at night by hand indicates that dragropes suitable for this work should be added to the equipment of

each piece. Frontal fire from light field guns against entrenched infantry, even at ranges around 2,200 yards, is not effective; flanking or oblique fire is required.

We have as yet said nothing about the use of heavy artillery. Despite the very rugged nature of the country, the poor roads, and the fact that oxen had to be used for drawing them, the Servians succeeded in getting their heavy guns up to their battle lines. The assignment of a certain number of heavy guns as a part of the Army Artillery has been urged, because their long range and great smashing power can frequently be used to keep down the fire of the opposing artillery while the lighter guns move up to a battle range and take up positions. Such was their successful employment at Monastir, and the lack of heavy guns at Tchataldja has been advanced as the reason for the failure of the Bulgarians to silence the exposed Turkish batteries which later played such havoc with their infantry. It was found also that the heavy guns could be used effectively to destroy wire entanglements, abbatis, and other physical obstacles to the advance of the infantry, something which the fire of the lighter guns could not accomplish.

PART II.—EUROPEAN WAR.

In 1912, Germany had about 3,866 light field guns; Austria, 1,854; France, 2,936; England, 1,170, and Russia, 4,432, only a certain percentage, however, of the latter being modern quick-fire guns, the others old type of Krupp construction. No figures are available as to the exact amount of heavy guns possessed by the various belligerents, but it is certain that in this respect, Germany and Austria were far ahead of their opponents. Due to the fact that the changes in the employment of artillery incident to the introduction of aerial observation are still going on, and because of the lack of comprehensive reports from competent observers, it is too early as yet to come to any definite conclusions as to the use of artillery under modern conditions, but it is possible to get some idea as to what has occurred to date.

The types of guns used by the Germans and their chief characteristics are as follows: 3.03-inch gun, weight of shrapnel and of high explosive shell, 15 pounds; muzzle velocity, 1,525; weight, 1,930 pounds; range, 5,800 yards: 4.2-inch gun—weight of shrapnel and high-explosive shell, 39.6 pounds; muzzle velocity, 1,970;

weight, 6,000 pounds; extreme range, 12,100 yards; 5.12-inch gun—weight of shrapnel and high-explosive shell, 66 pounds; muzzle velocity, 1,970; weight, 8,100; extreme range, 13,650 yards; 4.2-inch howitzer—universal shell weight, 31 pounds; muzzle velocity, 985; weight, 2,250 pounds; range, 7,100 yards; 5.9-inch howitzer—universal shell, 90 pounds; muzzle velocity, 985; weight, 4,300 pounds; range, 7,700 yards; 8.27-inch howitzer—universal shell, 248 pounds; muzzle velocity, 1,095; weight, 10,100 pounds; range, 8,900 yards; 11-inch howitzer, universal shell, 736 pounds; muzzle velocity, 1,150; weight complete, 30,644 pounds; range, 11,045 yards. This last gun uses semi-fixed ammunition, of eight different powder charges or zones, so that the initial velocity may be made to vary from 590 to 1,150. The guns below 9 inches in caliber are placed on stable carriages, from which they can be fired, not requiring a platform, but the heavier guns are transported in two or more loads and require some time before they can be set up for action. The German light field gun is inferior to the famous French 75. It is simply the old breech-loading type, to which modern mechanism has been added to overcome the recoil. The lower muzzle velocity, and consequently more curved trajectory, makes more precise ranging necessary because of the smaller danger zone from shrapnel burst, only 200 yards to the French 300 yards. The Germans had about thirty-three horse batteries of four guns each. They had no mountain artillery, but are reported as having borrowed six regiments from the Austrians, which are probably being used in the fighting in the Vosges.

The first great surprise in the way of artillery sprung by the Germans was the work of the now-famous 42-centimeter (16.8-inch) howitzer at Liege and Namur. For some time its existence was doubted, but this has now been definitely established. It is probable that there were not more than six or eight at Liege. One correspondent claims to have seen a battery of them in action near Metz. He says they were firing at half-minute intervals, that they were dug into the ground so that only the muzzles were visible. The following computed figures as to this gun are probably approximately correct; weight of gun, about 30 tons; projectile, about 2,200, with a bursting charge of about 100 pounds; muzzle velocity, 1,450; range, about 8 miles. To observe the fire, both aeroplanes and captive balloons were used, the former proving more satisfactory.

Another gun used by the Germans with almost as much success as the 42-centimeter is the Austrian 30.5-centimeter (12-inch), weight of projectile, 838 pounds; extreme range, 7,600 yards. The penetrating power of the shell fired may be conceived when we consider that the maximum ordinate of its trajectory is 4,374 yards. The effect of these two guns on the fortifications of Liege, Namur, and Maubeuge was terrific, concrete cupolas and gun turrets being overturned and the defenders, if not killed by fragments of shell, were often asphyxiated by the deleterious gases generated by the discharge. As a result, it may be said that the day of fortress warfare is past. This has been accomplished not so much by the size of the projectiles as the long range of the guns and the rapidity of their fire, which can be begun a very few minutes after the gun arrives in position. The only solution of the problem would be rows of concrete infantry trenches and numerous heavy guns carefully hidden, the line of defense on one side to be at least 7 miles from the other in order to prevent the defenders from being caught between two fires. To man these works would require a large army, which might better be in the field, the only purpose of permanent fortifications being to allow important strategic points to be held by comparatively small forces.

One of the most striking features of the campaign to date has been the reliance placed upon their heavy artillery in the field by the Germans, and the strength defensively which it has afforded by its use in strong and well-concealed positions, its long range enabling it to be placed behind woods or cover well to the rear of the center of the German lines. The German proportion of artillery is very large, the ratio of guns to rifles being about 6.4 to 1,000, as compared with the French 4.9 to 1,000. Each regular German division has on the average fifty-four field guns and eighteen light field howitzers, each corps four batteries of 5.9-inch or 4.3-inch howitzers, and each army of three or more corps, two batteries of 8.27-inch howitzers. Of the heavy guns, the problem of weight has been solved by an arrangement of girdles of connected and hinged steel plates around the tread of the wheel, attached in such a way as to revolve with it. We know from Sir John French's reports that these large guns were used during the battle of the Aisne, at ranges around 10,000 yards, that at first the English troops suffered very severely, but that deep and careful entrenching minimized the effect of the heavy fire considerably. A

hit quite near a trench, however, often causes whole portions to cave in burying the defenders. The range accuracy of these large guns is reported as remarkable, four shots often falling within 5 or 10 yards of each other. Rather than be exposed to their frontal fire, the British are placing their trenches on the reverse slopes behind crests, as they regard a very narrow field of fire in front of a trench as sufficient to stop an infantry attack. In soft earth in the open, the effect of these large shells is purely local, and they have evidently failed to produce the great moral effect which the German military philosophers had predicted. Their fire has not been directed against living or battery targets only. One use has been, as laid down in the German Heavy Artillery Regulations of 1912, to destroy roads over which it was necessary to transport supplies and munitions. Level areas used as landing grounds by the Allies' aeroplanes have also been ploughed up by shell holes, a practice which, in a wooded country where such level spaces are few, has caused many delays in aerial reconnaissance. The Germans have also dropped shells at irregular and unexpected intervals upon villages which might be used as headquarters or for billeting troops, which may well prove a very uncomfortable habit to an army serving in the winter without canvas.

The long range of heavy guns make the question of observation and communications doubly important. This at once leads us to what has certainly been the most spectacular feature of the war, one which has revolutionized the old systems of employment of artillery—the use of aeroplanes. It is true that in a great number of cases these guns are fired by the directions sent back by telephone from ground observers pushed forward sometimes as far as 4 miles to the front. The sausage-shaped observation balloons with which the German armies are equipped have also been used with some success, but by far the best work has been done by the cooperation of skilled observers in aeroplanes flying directly over the targets, who are thus able to indicate all errors in range and direction. According to the report of the "Official Observer" with the British forces, the aviator as he passes over the target drops a smoke ball or some glittering substance, to which the distance and deflection from the battery are at once obtained by a range finder and observation instrument constantly kept trained on the aeroplane. Fire being opened, the result is signaled back by the aviator according to some prearranged code.

The following description of a German 8.27-inch howitzer position near St. Michiel, by an Association Press correspondent, may be of interest: "The heavy German battery lay snugly hidden in a wood on the rolling heights of the Cote Lorraine. . . . The guns, two in this particular position, stood beneath a screen of thickly branching trees, the muzzles pointing toward round openings. . . . The gun carriages were screened with branches. The shelter tents of the men and the house for the ammunition had also been covered with green and around the position was a hedge of boughs. . . . The battery commander's post of observation was 1 mile nearer the enemy. He was communicating with the battery by telephone. . . . The guns had been firing for four days from the same position without being discovered, although French aviators had located all the sister batteries, which had suffered loss from shrapnel fire."

The German employment of light artillery has not been less skilled than the heavy. Handicapped with light materiel inferior to that of the Allies, they have yet given a good account of themselves. During the early drive on Paris and the subsequent retreat, when great deliberation was impossible and speed of fire was the prime consideration, they did not hesitate to place their batteries very near covering crests. This being before the art of aerial observation had reached its present state of perfection, the use of observation ladders was very frequent. The guns were nearly always dug in, the semi-circular embankments of earth about them being strengthened by the use of limbs of trees, sticks, or the wicker shell baskets carried by the Germans. After the preliminary operations of the war, as the use of aeroplanes in conjunction with artillery fire became more frequent, and perhaps influenced also by their disagreeable experiences with the French shell, the Germans began to select their positions farther to the rear of the covering crests, usually from 500 to 800 yards. The German Army has a highly efficient telephone system, and the battery commander or observation officer is usually well to the front in some commanding position or in an infantry trench, communicating with the battery by telephone. The guns are practically always dug in, and protected from aerial view by trees, straw, or other natural cover. They are also frequently shifted by night from one position to another. Batteries are often placed in isolated positions to take advantage of natural cover, but control

of all batteries under his command is retained by the battalion commander in order to keep the direction and rate of fire at a uniform pitch and to prevent waste of ammunition. The German Minister of War, in his letter of advice on the training of new German armies, says that it is often necessary to employ searching fire for hostile artillery in covered positions, but this must be done with caution, as every shot fired needlessly is a crime. For this searching fire the cooperation of areoplanes is necessary.

The German shrapnel, according to all reports, has proved very defective, its burst being high and irregular and often failing to produce killing effect. In the fighting along the Ourcq in early September, according to a French Zouave officer, only one German shrapnel in four burst at the proper height. Their high explosive shell, however, has given excellent results. The English admit the accuracy of the German fire, as also the great speed with which it is concentrated upon a selected point. In ranging, the Germans seem to have dispensed with bracketing, especially when acting on the defensive, and direct their fire by means of squared maps and the telephone. It must not be gathered from this that squares are searched at random, but a target, when discovered by aero, is located on the map and a battery told off to fire upon it. The Germans have paid much attention to the question of reconnaissance of positions. Their new firing regulations state that on preliminary reconnaissance the battery commander shall be accompanied by two noncommissioned officers equipped with aiming circles. The musicians are also noncommissioned officers who are qualified to take part in this work.

After fighting in the western theater had settled down to a trench warfare, in which the trenches of the opposing forces are only two to three hundred yards apart, sometimes as close as 50 yards, the superiority of the Germans in howitzer equipment at once began to assert itself. As compared with the gun, the light howitzer in this class of work has two points in its favor—first, the high angle of fall of its projectile makes it more effective in piercing horizontal head cover and in searching areas behind vertical cover, and, second, the lighter muzzle velocity causes less strain and wear on the piece during a period of continuous firing. The 4.2-inch howitzer, the best type of weapon the Germans possess, has seven different zones. At ranges of 2,200 yards and over, it has an angle of fall of about 28°. Its unit projectile, containing 425

bullets, has five different actions. It may be made to burst on percussion, both delay action and nondelay; it may be used as time shrapnel, time shell, or as canister. The high trajectory of these guns enables them to be pushed farther to the front than the more powerful guns with flatter line of fire. One correspondent describes a howitzer battery in action near Comines. In a wide area without trees, these guns, only 10 feet apart, were placed in a muddy flat of ground, and thoroughly daubed with mud so that no glint of steel could show. Limbs of trees were woven about and over them so as to present to the aviator the appearance of a clump of bushes. In a pit to the rear was the inevitable telephone operator in communication with an observer to the front in an infantry trench.

Another type of howitzer specially designed by the Krupps to meet the conditions of trench warfare is the so-called "meinenwurf" or mine-thrower. Weighing only 128 pounds, or weight complete on bed 1,160 pounds, the carriage having handles like those of a wheelbarrow, it can be wheeled about by two men. It throws a spherically shaped shell weighing 185 pounds, fitted into the bore by a loose handle which drops out in flight. Its muzzle velocity is only 200 feet, and at ranges of 350 yards and less, it has proved very accurate. The German anti-aircraft guns, high power weapons mounted on a pivot and borne on motor trucks, so that they can fire at any height and in any direction, are another Krupp product which have proven very successful. Their accuracy and power have been such as to force the aviators of the Allies to keep to heights of 8,000 feet, thus increasing the difficulties of aerial observation. The Allies now claim that the steady output of their gun factories has at last enabled them to reach a status of equality with the Germans, so that they will be at a tremendous advantage from shortage of artillery as they were during the early months of the war.

At the beginning of the war, the Russian artillery was a very uncertain proposition. In fact, the Germans felt confident that they would be able to overwhelm it easily. But its efficiency has been one of the big surprises of the campaign to date, and this the Germans admit themselves. In matériel it is considerably mixed, the older type being almost entirely of Krupp make. But the newer type guns are of French manufacture, the field-gun, a very high powered weapon, being in some respects better even than the famous

French 75-millimeter. This gun, caliber 3 inches, with a muzzle velocity of 1,930, is of about the same weight as the French gun. Its shrapnel, containing 260 bullets, weighs about 14.5 pounds, and it is also supplied with high explosive shell. The battery organization is one of eight guns each.

The Russian proportion of heavy artillery, though not so great as the German, was larger than either the French or English. They have a considerable number of light howitzers, also a number of 4.7 inch howitzers, both of Krupp and of French make, the European organizations being armed with the former and the Siberian with the latter. These Siberian troops, by the way, have won quite a name for themselves in the fighting in Russian Poland. A strong increase in the number of heavy field howitzers was apparently made shortly before the war, so that each Army Corps now has three or four batteries assigned to it.

It has proven very difficult to get any idea of the work of the Russian artillery. It is true that there have been a number of articles written by war correspondents with the Russian armies, but these have been characterized by glowing descriptions of the scenic effects rather than by any reference to technical details. The facts given below have been taken largely from an account of the Russian artillery by a German artillery officer serving in the eastern theater, and must be accepted as such. He seems on the whole, however, to be fairly reliable and to be inclined to give credit where credit is due.

The chief characteristic of the Russian artillery leaders has been their very skillful use of positions. Their guns are rarely or never placed on or near prominent crests, but in deep-lying positions affording ample defilade. They have not hesitated to place their guns in meadow land, and in the fighting about Ivangorod the heavy artillery was situated on the swampy banks of the Vistula. If natural cover was not at hand in such places, it was artificially provided by piling up wood from nearby thickets or by constructing earthen embankments in front of the guns in such a way as to resemble the potato fields of the region. The embankments were extended well around to the side so as to cut off the view of flank observers, and were of sufficient height to conceal the flash of the discharge. They were laid out so skillfully that it was very evident that the field of approach had been carefully studied from the front. In thickly settled country, the guns were often placed in the middle

of villages or in gardens, and in wooded country in the edge or even in the middle of woods, in which case sufficient trees were cut away to make room for the guns and provide for a field of fire. In these positions, the guns themselves were seldom placed in pits, but ample cover for the cannoneers was provided by the digging of trenches, so that although the service of the piece might be affected, it was practically impossible to destroy the personnel. In several such positions it was evident that the caissons and limbers had been left behind cover to the rear and the ammunition brought up through the deep communication trenches.

As very few of the Russian batteries seem to carry observation ladders, it was usually necessary for the battery commander to post himself for observation at a considerable distance from his guns. His choice of station was not closely restricted by consideration as to distance, for each battery seems to carry cable drums of fairly strong and well insulated telephone wire of 1,000 to 1,500 meters in length. These observing stations were in a number of cases more than a mile away from the guns, and were so well concealed, in high trees, in church steeples or on high pieces of ground that it was almost impossible to detect them. One correspondent relates how, during the siege of Lodz, a Russian colonel of artillery at night, accompanied by a few assistants, dragging a telephone wire, made his way out from his own lines to within half a mile of a German heavy battery which was doing much damage. "While a searchlight was swinging over the face of the country, he lay on the ground and from there directed the Russian guns, which with his help succeeded in silencing the battery. The Russians' guns were at the time placed in the streets of Lodz."

Several excellent position sketches found by the Germans in captured buildings proves that the Russians study the terrain carefully, as they showed all features of any tactical importance. Their service of reconnaissance and of information seems to be very highly developed. There is apparently a central headquarters for the assembling and dissemination of information. The Russians often upon the basis of such information searched areas in which the presence of hostile artillery had been reported, although the target itself might not have been visible.

The effect of the Russian fire is reported as not at all in proportion to the quantity of ammunition expended. Near Ivangorod one German battery was for five days under the concentrated fire of light

and heavy howitzers, and in this time only four men were hit. Failure to control the rate of fire by the higher commanders seems to have resulted in a needless waste of ammunition. Perhaps this was because they were operating near Warsaw and Ivangorod so that the supply of ammunition was plentiful. The field guns used shrapnel almost exclusively, the heavy howitzer six-gun batteries often fired mixed volleys, two shrapnel and four shell, or the opposite, perhaps hoping in this way to keep down the personnel of a battery and at the same time stand some chance of damaging the materiel. The Russian artillery is reported to have been much more efficient on the defensive than on the offensive, when, due again to lack of fire control by the higher commanders, the individual batteries seemed to be shooting about the country at random, their fire confused and overlapping, and not coordinated with the work of the infantry. Perhaps several more months' experience, however, have made the Russians less open to criticism in this respect. In fact recent reports of the fighting in the Carpathians tend to show that the artillery has been their chief reliance in forcing their advance.

The beginning of the war found the French sadly short in heavy artillery, a state of affairs due mainly to the confidence they had placed in their famous 75-millimeter field gun. They had argued that many small shell accurately placed would do more damage than a few big ones, shorter range being compensated for by greater mobility. Up to 1914, they had only twenty-one batteries of the Remailho 6.1-inch howitzer. In May, 1914, the new army law provided for immediate organization of twenty-four 6.1-inch howitzer batteries and thirty-four 4.13-inch gun batteries. It is fairly certain that few, if any, of these were available at the outbreak of hostilities, but it is likely that they were at the front by the end of 1914 and equally probable that a great many more are ready for service now. The howitzer is transported in two loads, fires a 94-pound shell, and has an effective range of about 7,000 yards. The gun, weighing about 5,730 pounds, fires a 36-pound shell at an initial velocity of 1,870; effective range about 10,500 yards. The few howitzer batteries used during the early operations along, in all likelihood, with some of the old 120-millimeter guns fired from a wooden platform, even though able to locate the German artillery, found themselves outranged by the heavy German guns and often unable to do effective work, as the artillery duel frequently occurred at ranges around 8,000 yards.

The French organization provided for thirty batteries of four light field guns to each army corps, thus having 120 light guns as compared with the German 144. The French field gun, which has done such good work, is 2.95 inches in caliber, the shrapnel weighs 15.96 pounds, the shell 11.6. The muzzle velocity is 1,738. The gun has the independent line of sight; traverse on the axle, the center of motion being the end of the trail. This makes for great stability of carriage during fire and hence great rapidity. The hydro-pneumatic recoil mechanism has proved very successful. Thus for six days during the battle of the Marne, the French guns averaged 600 rounds per gun, at the end of which time there were no noticeable effects of wear or strain.

Perhaps the most noteworthy feature of the work done by the French has been the wonderful success of their high explosive shell. Weighing only 11.6 pounds, this projectile is thin walled, containing a bursting charge of 29 ounces melinite, as compared with a bursting charge in the German shell of 5.5 ounces. Its initial velocity is 1,920. It has a delayed action fuze, designed to give a burst at a height of 5 or 6 feet after the shell leaves the ground upon ricochet. Its destructive effect when this result is obtained is terrific, one instance being reported in which one volley put out a German battery of four guns. Although the shrapnel has worked well, the fuse action being perfect, the French artillerymen are now asking for the shell exclusively, and it is being turned out from the factories at the rate of 40,000 rounds a day. A device known as the "plaquette" is also of interest. It is a small tin disk, held in place on the nose of the projectile by the fuze, its resistance to the air forcing the projectile upward in flight, thus increasing the angle of fall. Its invention was perhaps another reason why the French found themselves short of howitzers when they needed them.

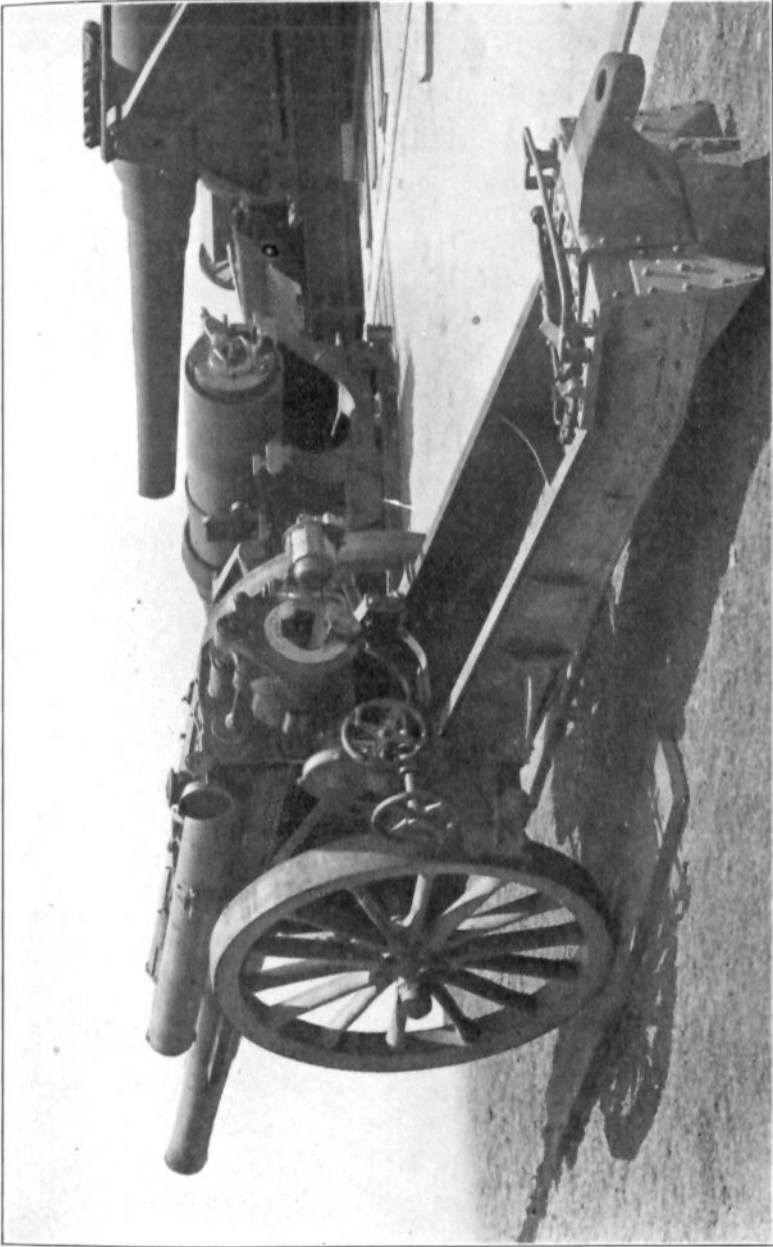
The French seem invariably to have placed their guns in masked positions, and so cleverly concealed that the Germans could locate them only by means of aeroplanes. They were usually more than 400 yards in rear of the crest, so that although the Germans might range successfully upon the crest, they seldom searched far enough to the rear to find them. The construction of natural overhead cover because of aeroplanes has become necessary, trees, brush, straw, anything to conceal the guns being used. For the same reason, the prime necessity of concealment, the use of the observation ladder seems to have become a thing of the past, commanding

features of the terrain or a post in the infantry trenches being favored for observation. At the end of the trail of each gun it has become customary to dig a hole enabling extreme elevation to be secured for fire against air-craft, which has often been successful. Telephone communication has been the rule, civilian telephones being often used because of the frequent failure of the French military phone. The French handling of fire has been skillful, ranges, with the aid of range finders, being determined quickly and brackets shortly established. When targets have been definitely located by air scouts, inhabitants of the country, or observers left behind, progressive fire for effect has been used. Control of his guns, even though the individual batteries be separated rather widely, has been retained by the battalion commander, who, though not conducting the fire, assigns each battery its approximate position and mission, watches the fire closely, and with the idea of having a reserve at hand if necessity arises, employs only as many at a time as are actually needed.

The English expeditionary force which went to France shortly after the outbreak of the war was equipped with artillery as follows: Three brigades, or fifty-four field guns, assigned one to each infantry brigade, three batteries, or eighteen 1.5-inch field howitzers, and four 5-inch heavy field guns. That they were ill-prepared to cope with the heavy German artillery is shown by the following excerpt from Sir John French's early reports: "Our experiences in this campaign seem to point to the employment of more heavy guns of a larger caliber in great battles which last for several days, during which time powerful entrenching work on both sides can be carried out." Late in September four 6-inch howitzer batteries arrived from England, and, according to the report were used with considerable effect during the fierce fighting of October.

The English light field gun is 3.3 inches in caliber, of about the same weight as the French, muzzle velocity 1,590, firing an 18.48 pound shrapnel. The 5-inch gun has an effective range of 10,000 yards, the 6-inch howitzer, firing a shell of 122 pounds, a range of 7,000 yards. Later a 9.2-inch howitzer, firing a 290 pound shell, with an effective range of 10,000 yards, gave good results, and it is probable that more have been or soon will be in operation.

The high powered long range guns of the Germans have forced the English not only to place their guns in covered positions well to the rear of the covering crests, but to take measures to conceal



ANOTHER VIEW OF BRITISH 60-POUNDER FIELD GUN.

them entirely from aerial view. In this they have apparently become very expert. Fighting in a wooded country, the guns, if not in the edge of the woods, are covered with transplanted trees or bushes, or placed in sheds and buildings, and all the matériel likewise hidden. When certain natural features of the terrain offer especially good concealment, or when as often happens one or two guns are detailed to fire upon some particular target, they are frequently hidden singly or in pairs. British aviators by inspecting artificially constructed shelter from above assist in perfecting it, and all motion of personnel ceases upon the approach of hostile aeroplane, it being considered better policy to remain snugly hidden in a good position than to attempt to bring down an aerial scout by firing upon him. Elaborately built bomb-proof shelters or pits near the trail of each gun afford protection to the cannoneers, and unless the situation, such as the support of an infantry attack, demands continuous and rapid service of the piece, shelters are at once sought if the battery is taken under fire. It must not be concluded from the above, however, that the British batteries have been at all tied down to their positions. Thus during the fierce German attack near Ypres, when it seemed as if they were about to break through the thin English line, four batteries galloped out into the open to within 600 yards of the attacking Germans, and the fierce fire which they opened continued until the attack stopped.

Visual signaling has been found almost wholly impracticable, chiefly due to the elaborate spying system maintained by the Germans, and communication is almost wholly by telephone, or when the sound from a great deal of firing makes the use of telephones difficult, as is often the case, by buzzer. Actual control of the fire of the battery seems to be retained by the battery commander who remains with or near it, but he relies largely upon the observation of a lieutenant in an infantry trench or in a building well to the front, communicating with the battery by telephone or buzzer. In these more or less permanently occupied positions, the range and deflection to all prominent points in each battery sector have been definitely established. When the approximate location of a target not visible from the observing station is reported by aeroplane, recourse is had to maps for obtaining firing data, the deflection being taken, for instance, from a point of the compass and the angle of site from the contours. The use of observation ladders has been discarded in favor of a specially dug trench on a slight rise of ground or a post forward in an infantry trench.

Control of the elements under them seems to have been closely maintained by the higher commanders. In the early operations, an artillery brigade was assigned to each infantry brigade, and it was the duty of the artillery leader to keep in close touch with the infantry commander. At present the direct control of all artillery is vested in a chief of artillery at all times, except when an infantry attack is to be made, when one or more artillery brigades are assigned to it for its support. Certain experienced officers are assigned the sole duty of assisting the artillery commander to keep in touch with the infantry. He has also at his disposal powerful armored motor cars, armed with light quick-fire guns, which are reported to have been very successful in dislodging the Germans from villages or from outlying flank positions.

Before we attempt to draw any conclusions from the employment of artillery in Europe as particularly applicable for our own use, we must bear in mind the very peculiar conditions, which, it may safely be said, will never exist in this country; two armies facing each other in deeply entrenched positions, only two or three hundred yards apart, often less, one flank resting on the frontier of a neutral nation, the other on the sea. The theater of operations is only two to three hours distant from the base of supplies, magnificent roads, still in very good condition in spite of the hard usage they have undergone, and a network of railways facilitate transportation of munitions. All this, of course, is not true of the fighting in the east, but, as previously stated, data as to it is as yet scant. After all, though, the following conclusions seem to be warranted now, and additional information will probably only tend to confirm them: Our present proportion of shell to shrapnel is too low, also a much more powerful shell should be adopted; artillery in the future will generally fire at longer ranges than the ones in the past considered as the average; perfect coordination is necessary, not only between the artillery and the infantry, but also between the light and heavy artillery, the need of which last has been demonstrated; batteries must be trained to conceal themselves not only behind vertical cover, but from overhead view as well, and to do it quickly; steps must be taken toward the cooperation of artillery and aeroplanes; officers must be able to direct battery fire readily from a distance, also by map location, and, for the two are inseparable, our systems of communications must be perfected—the better our telephone, the more sure and rapid will be our fire.

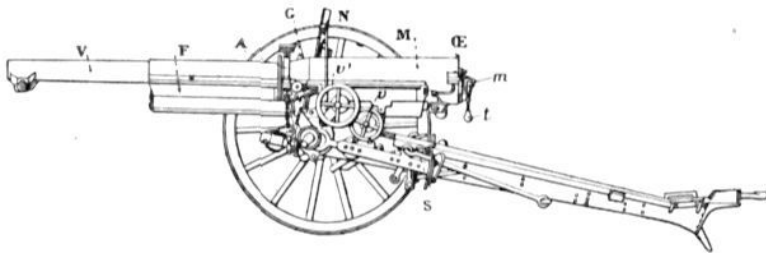
THE TWO FIELD PIECES IN USE, OUR "75" AND THEIR "77."

Translated from "L'Illustration." December 12, 1914.

BY LIEUT. CHARLES A. DRAVO, 29TH INFANTRY.

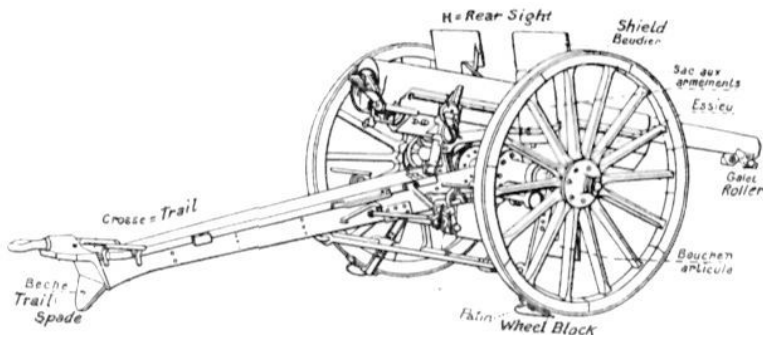
THE PRESENT FRENCH 75-MILLIMETER (2.97-INCH) FIELD PIECE.

In the French piece the barrel is reinforced with a sleeve fitted on cold, as experience has taught that when shrunk on hot molecular alterations in the metal result. The barrel is 8.145 feet long about 33 calibers.



LEFT HAND VIEW, LEFT WHEEL REMOVED.

V, chase.—*M*, sleeve.—*F*, hydropneumatic brake.—*A*, aiming device.—*G*, point-ring sight.—*N*, level.—*OE*, eyehole.—*m*, hammer.—*t*, lanyard.—*v*, elevating screw.—*v'*, deflection screw



RIGHT HAND VIEW.

The French 75 Millimeters Rapid Fire Field Piece.

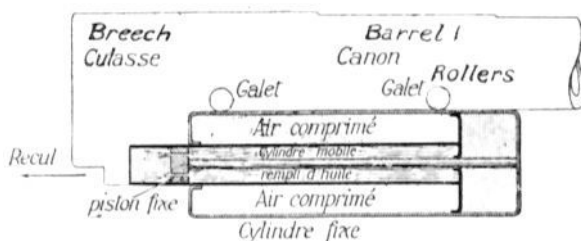
In the de Reffye et de Bange model the breech closure is made by an interrupted screw situated in the axis of the piece. The breech opens like a gate, three motions being necessary. In the 75, model 1897, the breech-plug, formed by a large block, the diameter of which is more than twice that of the bore and the axis of which is below that of the piece, works over an eccentric screw. This block,

screwed into the piece, the after part of which forms the female screw, is pierced by a large channel which is brought in prolongation of the bore of the piece by turning the block through 180°, another half turn brings the solid part of the block against the breech of the piece and assures the closure. Both of these maneuvers are made by means of a breech plug handle and by a single movement.

Fixed ammunition is used. The piece is discharged in the same manner as in small arms; that is, by a firing pin in the breech block, which is operated by pulling on a handle. Perfect gas checking is obtained by the expanding gasses pressing the brass cartridge case against the walls of the bore. The case is automatically extracted and thrown to the rear when the breech block is opened for a new charge.

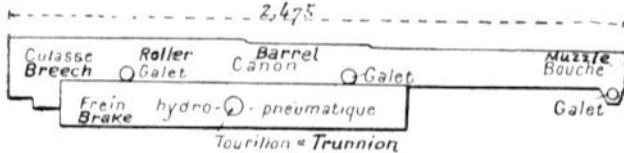
The Hydropneumatic Recoil Brake.

Absence of recoil which results in keeping the piece in battery and on the target is obtained by means of the hydropneumatic brake, an essential characteristic of the French gun, and is thought superior to other similar methods in use in foreign armies. The barrel does not attach directly to the carriage, but rests on a movable cylinder which fits into a larger and stationary cylinder, which is fixed to the carriage. The movable cylinder, which is filled with oil, is traversed along its greatest axis by a shaft, one end of which attaches to the fixed cylinder and on the other end of which is a piston head



perforated with small holes. The annular part between the two cylinders is filled with compressed air. The recoil of the barrel draws the oil cylinder along the perforated piston head and at the same time reduces the volume of the compressed air chamber resulting in a double resistance against the recoil. The energy of the recoil being exhausted, the compressed air in the fixed cylinder, called the recuperator, draws the movable or oil cylinder back to its initial

position, the oil again passing through the piston and the piece being brought automatically into battery. The length of the recoil is 3.947 feet. The brake is closed in an envelope, over which the barrel runs on rollers. At the end of the recoil the barrel has an overhang and is prevented from dropping by the rollers at the muzzle, which engage in channels cut into the brake hood.



Satisfactory functioning of this gun depends essentially upon the carriage being fixed and this is done by the trial spade, which anchors itself in the ground on the two first shots. In addition, during firing, each wheel rests against a block furnished with a similar spade. These three points assure the immobility of the carriage, and firing may be continued without replacing the carriage or correcting aim after each shot.

Laying the Piece.

On an intermediary apparatus are fixed the elevating screw and the cross-haired telescope. The gunner by operating the elevating hand-wheel controls the plane of the cradle and by moving this plane he gets his angle of elevation or depression, that is, the angle formed by the horizontal plane with the line of sight. The barrel, since the elevating screw is bound to the cradle, follows the movements of the latter. The angle of site is given but once and maintained by keeping the bubble of the level between the proper marks.

Th angle of fire is governed by a hand wheel, which modifies the position of the barrel with reference to that of the cradle without changing the position of the latter; that is to say, without deranging the plane of collimation. This is done mechanically, without sighting, by means of graduations on the drum of the rear sight. Finally, for direction, the target is sighted with the telescope, the lateral displacement of which includes that of the carriage, and as a result that of the piece through a sliding motion on the axle! This pivoting is operated around the trail spade fixed in the ground. The

angle of deflection is measured on a special instrument called the goniometer.

The different operations are almost simultaneous: the gunner gives the direction and the angle of site, while the cannoneer, who cuts the fuse, prepares the projectile. Thanks to the nearness of the caisson, the loader may receive the projectile and insert it in the bore without disturbing the firer, who gives the angle of elevation and closes the breech before firing the piece. The cannoneers do not have to get out of the way of the wheels, which do not budge or leave the protection of the shields. In fact, after the second shot, the gunner and firer need not leave their seats on the carriage. All of these arrangements promote the rapidity of fire, which has reached a speed of twenty shots a minute.

The Projectile.

The projectiles used in the 75 are of two kinds, shrapnel and explosive shell.

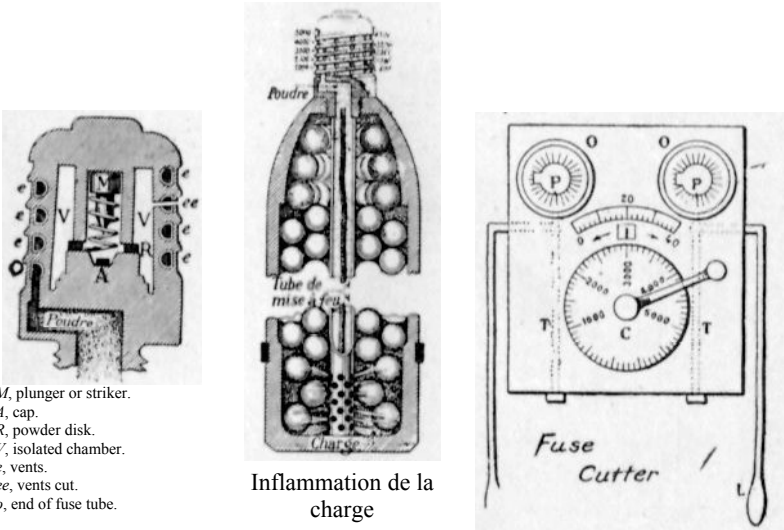
The shrapnel weighs 15.9 pounds and contains 300 balls of hardened lead weighing about one-half ounce each. The shell is 13.2 inches long and 5.5 millimeter (.216 + inches) thick. There are three models, differing but little, and all consisting of a steel head ogival in shape in which the balls are placed in layers and mixed with compressed powder. A layer of saltpeter covers the charge which is traversed by a brass tube in which is placed a quick-match and which is pierced near its lower extremity by holes through which the flame gets at the charge. The quick-match is lit by a time fuse and causes the projectile to burst at a given time. Both time and percussion fuzes are used. The projectiles are placed in the caisson, head down, to the number of ninety-six. The caisson is placed next the piece and at its foot is the automatic fuse cutter.

The fuse cutter includes the two ogival openings O in which the head of the projectile is placed and the fuse cut by the punch P mounted on the shaft T and operated by the lever L. By turning the handle on the graduated dial plate C. the height at which the fuse will be cut is determined. (See cut next page.)

The Fuse.

In the interior of the fuse, which is screwed to the head of the projectile, in an isolated chamber is installed a striker with its point toward the shell. This striker is independent, being held in place

by a coiled spring on which it rests. A few millimeters below it is placed a fulminating cap surrounded by a disk of compressed powder. When the shot is fired inertia throws the striker back against the fulminating cap with sufficient force to detonate it and fire the disk of compressed powder. If the fuse has not been cut the powder flame remains in the isolated chamber. Around the exterior wall of this chamber is wound a tube of lead filled with priming powder that burns



M, plunger or striker.
 A, cap.
 R, powder disk.
 V, isolated chamber.
 e, vents.
 ee, vents cut.
 o, end of fuse tube.

Inflammation de la charge

Fuse Cutter

with mathematical regularity and the lower end of which connects with the charge. The spiral lead-filled tube is covered by the exterior envelope of the fuse and along its length is disposed a series of vents. To fire the time fuse it is necessary to punch a hole in it and the wall of the fuse to expose the priming powder to the flame of the disk of compressed powder ignited by the detonating cap. The priming powder in turn connects with the quick-match which carries the flame to the base of the charge of the projectile. The higher the fuse is cut the longer the train of time fuse to burn before explosion takes place.

The explosive shell, called the Melinite, is the same length as the shrapnel and weighs only 5.3 kilograms (11.06 pounds). It is also of steel tinned on the interior as melinite attacks all metals save pure tin. It is charged with an explosive compound composed of 60 per cent cresylite and 40 per cent melinite. The upper part of the charge is filled up with pulverulent melinite. The total weight of the

charge is 830 grammes (1 pound, 9.7 ounces). It is capped with a percussion fuse and on bursting scatters 200 pieces of an appreciable size.

THE GERMAN 77-MILLIMETER (3.05-INCH) FIELD PIECE.

The German 77-millimeter is 2 meters 10 long (6,889 + feet) and 27.3 caliber. The mechanism of breech closure, firing, shell extraction are strong, simple and comparable to the French 75. The recoil brake, based on the same principle as the French 75, functions in an analogous manner. It includes a movable cylinder filled with glycerine and attached to the barrel which recoils with it. This cylinder is surrounded by a series of metallic springs which are compressed during recoil and on expanding return the barrel to its initial position. These springs play the same rôle as the compressed air in the French 75 and the regularity and duration of their action leaves something to be desired.

The sighting devices, which are not here described, are much less perfect than the French.

TABLE OF DIFFERENCES

| | <i>French</i> | <i>German</i> |
|---|---------------|---------------|
| Length of piece, feet | 8 | 6.88 |
| Maximum range, time fuse, yards | 7098 | 5696 |
| Weight of projectile, pounds | 15.9 | 15.07 |
| Weight of projectile charge, pounds | 1.54 | 1.25 |
| Initial velocity, foot-seconds | 1735 | 1525 |
| Velocity at 1,000 meters, foot seconds | 1354 | 1210 |
| Velocity at 2,000 meters, foot-seconds | 1095 | 1016 |
| Velocity at 3,000 meters, foot-seconds | 951 | 902 |
| Kinetic energy at muzzle, kilograms | 103.5 | 75 |
| Kinetic energy at 2,000 meters, kilograms | 40.9 | 33.6 |
| Number of shrapnel balls | 300 | 300 |
| Weight of shrapnel balls, grains | 185 | 154 |
| Danger zone for target one meter high: | | |
| At 1,000 meters, feet | 134 | 101 |
| At 2,000 meters, feet | 49 | 39 |
| At 3,000 meters, feet | 25 | 21 |
| Thickness of shield, inches | 1/8 | 1/5 |
| Weight of piece in battery, pounds | 2420 | 2090 |
| Weight of piece limbered (without cannoneers), pounds | 4180 | 3900 |
| Weight of caisson, limbered (without cannoneers), pounds | 4290 | 4070 |

Finally, the only advantages that seem to lie with the German gun are the following: Once in battery the piece and caisson weigh less than the French. The surface of the protecting shield is 1.44 meters

whereas in the French it was 1 meter, but has lately been increased to 1.30 meters.

On the other hand, the German piece is notably inferior in stability, facility in aiming, sweeping, fuse setting, searching in depth, rapidity of fire, power and mobility of fire and ballistic qualities. The German projectiles are less effective than the French, the superiority of which is due in a large measure to the quality of the explosive used. Furthermore the lighter weight of the German piece does not gain for it in mobility over the French as the weight including attendants is the same. The French caisson weighs about the same as the German though it carries ninety-six rounds instead of ninety and when loaded with explosive shells weighs 200 kilograms (440 pounds) less than the German caisson.

Before the war every French artilleryman maintained that the superiority of the French gun would largely compensate for the fewer number of pieces attached to the French Army Corps (thirty batteries of four pieces making a total of 120 guns for the French against twenty-four batteries of six guns attached to the German corps). Lieut. Gen. Beyel explained it as follows: "A French battery of four pieces sweeps with fire a greater space of ground in less time than the German battery of six guns and we have thirty batteries per army corps against their twenty-four."

Actual field work stamps this opinion with practical approval.

ARTILLERY POSITIONS.

BY MAJ. BROOKE PAYNE, 6TH FIELD ARTILLERY.

The following paper was read by the battalion commander at one of the meetings of the officers of the 1st Battalion, 2nd Field Artillery at Fort McKinley, P. I., in the summer of 1911, and is printed here with the hope that it may prove of interest.

I was prompted to discourse on the subject by the remark often heard during maneuvers that this or that piece of ground would make a good artillery position—the impression being produced by regarding the topographical features of the ground itself without any consideration being given by the speaker to the requirements of the task to be fulfilled by the guns in question.

This is a mistaken idea of the meaning of terrain so far as artillery is concerned and is quite common among officers of the other branches of the line.

The subject of the paper is "Artillery Positions"; it will not deal with the subjects of the approach to and occupation of positions. The latter matters are of such great importance that they require separate consideration.

Strictly speaking, the occupation of a position is a part of the position itself, since the value of any position depends in a large measure upon the skill with which it is occupied, but I have limited my remarks to the title proper.

The object of this paper is (1) to point out that too much importance should not be attached to the protective value of *natural* masks; and (2) that the conditions affecting the selection of appropriate battery commanders' stations change with the phase of the action, or with the task of the guns.

In arriving at these deductions I am able to refer to the writings of acknowledged authorities in artillery matters.¹

"One very capable writer has stated that there is no such thing as an artillery position. It may at least be said that a perfect position cannot be found, and time should not be spent needlessly looking for one."

¹The numerous quotations appearing in this paper have been extracted from articles appearing in the *Infantry Journal* and FIELD ARTILLERY JOURNAL of our Army, from Col. Bethel's "Modern Artillery," pages 270 to 273, and from our Drill Regulations.

Furthermore, what would be a good position for one task would be a poor one for certain other tasks.

In any case, it is always a special problem—a special situation calling for a required solution—and generally involves this question: Which is more important in the execution of this task—concealment or a large field fire for immediate and varied action?

Our drill regulations (1911) states in italics: "The only invariable rule in the choice of a position is to post the guns so as to be able to effectively carry out the task assigned to them." This is an excellent, though very general and hence indefinite rule. Then follow six important considerations to be taken into account. It will be observed that some of these considerations are mutually exclusive.

It is generally conceded that, in the preliminary stages of a battle, firing will be from well concealed positions; but this does not mean that all batteries must at once be placed in positions well under cover or far behind screens.

It would seem out of the question that there should have arisen any discussion over the necessity for masked positions, or over their advantage over positions in the open. Such discussions did take place however and resulted in what all military problems ultimately amount to—namely a common-sense proposition. The discussion arose out of the fact that parties thereto had taken opposite stands on the question. The outcome was the getting together on common ground and the acceptance of the fact that there is no general rule. (To refer to this point read pages 211 *et scqua* FIELD ARTILLERY JOURNAL. Vol. I.)

"When the conditions are such that the collective fire of the battery can be directed on a *well-defined target*, the concealed position has many advantages over the open. The greatest of these is the element of surprise."

In a sense, batteries in such positions may be regarded as a "reserve of fire power."

"Another advantage of the concealed position is the power which it confers of changing position without the enemy's knowledge." Our drill regulations (1911) say that "when not incompatible with the duty to be performed, concealment from view is always to be sought." But while "use must be made of all means at hand to render more difficult to our enemy the reconnaissance of our position," it should be borne in mind "that, on the other hand, we must expect to find the difficulties of procuring information and reconnoitering

the objective greatly increased" in the totally concealed position. From such positions the successful attack of fleeting targets is of doubtful issue.

The advantage of posting guns far in the rear of covering crests should not be over-estimated, no matter from what point of view you may consider it. There is here difficulty, both mechanical and otherwise, of conducting fire from distant observing stations.

Fire against certain targets and great concentration of fire will be impossible of attainment from this class of position.

Lieut. Neuffer, of the 3rd Bavarian Field Artillery, in an article appearing in our FIELD ARTILLERY JOURNAL states "I believe that in the future and in the majority of cases we shall seek positions sufficiently defiladed to afford protection from registered fire. * * * Usually these positions may be taken quite close to the crest, especially if the flash from the gun can be done away with, so that when necessary the batteries may be quickly moved up to the crest. Naturally there may be times when batteries posted far in rear of the covering crest may fulfill certain special tasks."

These ideas are not exactly in conformity with the inferences likely to be drawn from our drill regulations, but they are not at variance with the general principles laid down therein.

It is this readiness to participate in any kind of a task that I wish to call especial attention to, and which I believe in the long run will prove the measure of a good position.

"There is absolutely no excuse for artillery remaining idle in the face of the enemy; if they cannot see him, they must push forward until they do, even if this entails their being used as machine guns."

It has been pointed out to us, however, in notes from Russian Artillery School that, "it has been demonstrated clearly that artillery should not be brought into position when opposed by machine guns at ranges less than 1,860 yards, and that it is better to attack machine guns at short ranges with machine guns."

I do not wish anything that I have said or intimated to be taken as lessening the importance of concealment. Every effort must be made to *conceal* the guns. But mere concealment offers no additional protection over that attainable in open positions; and "the *protection* afforded by the concealed position is a secondary matter, since protection must always be considered as subordinate to effect. But it may enable a small force of artillery to cope with a larger

force, which is an important consideration as affecting our own small Army. In this connection, it may be pointed out that the protection obtained in the concealed position is due solely to concealment from the enemy's view."

"No considerations of safety, however, should deprive the infantry of the support of its artillery."

The necessity of intrenching our guns seems therefore to have increased in spite of the advent of the shield. "It should be considered a rule that any position occupied by artillery, whether hidden or not, should before opening fire be provided with trenches." This is certainly and especially necessary in the case of mountain artillery.

The same German officer quoted above remarks, that "cover and intrenching, without which the Russo-Japanese War could not have been prosecuted, are quite as essential to our armies, in *addition to the shields*, wherever time and place permits their use."

OPEN POSITIONS.

In some cases open positions *must* be occupied: as for instance:

- (1) If there be no hidden position that satisfies the tactical or technical conditions required by the guns.
- (2) If the enemy has no artillery, or if his artillery is relatively too weak to act successfully.
- (3) In all cases demanding *certain* or immediate aid to one's own troops.
- (4) In the pursuit or in covering a retreat.

THE BATTERY COMMANDER'S STATION

In regard to the location of the battery commander's station. I am not convinced that the artillery experts have definitely and conclusively solved the question as to where the station should be located with reference to the guns.

Lieut. Neuffer says: "It is important however, that the battery commander should select his observation station so as to be able to control his battery by voice." etc.

Maj. Summerall says in an article in the *Infantry Journal*: "The battery commander should be able to view the field of fire from a point near enough to command the battery." This is often impossible. Our drill regulations state: "To facilitate the quick transmission of orders and to the proper exercise of command, the

battery commander's station should be as near the guns as the conditions permit."

While recognizing that our telephone service may not yet be relied upon to maintain communication, I still believe that the time is not far distant when there will be a great improvement both in the material and service of the telephone, resulting in the modification of the rules just quoted, so that they will conform somewhat to the same influences that affect the type of position to be occupied.

Drill regulations say: "The officer conducting the fire should be posted where he can observe not only his immediate target, but as much as possible of the terrain liable to be assigned to him to attack. Unembarrassed by details of the service of the guns, he should devote himself to observing and correcting the fire, etc." Even with the present telephone equipment he can greatly facilitate his control of his battery by wearing the telephone himself and having his executive do the same.

In the ordinary course of events he would have no more occasion to leave his station and go down to his guns than the commander of a battleship would have to leave the bridge and visit his turrets.

Finally the loss of no other one man in the battery so clogs the service of the guns as that of the battery commander. This should have some weight in determining his station, but very little as compared with other considerations.

In general, then, it might be stated that the further the guns are behind a covering mask the greater will be the removal of the battery commander from his guns; and that in all cases he should place himself with a view of observation and work for a better telephone service and perfect his semaphone communications.

The summary of what I have said regarding artillery positions is, then, this:

There is no such thing as natural *cover*. Batteries must look for cover in their gun-shields, in their intrenchments, and in the protection incidentally afforded by concealment.

There is, however, such a thing as natural concealment, and this must be augmented by artificial concealment and by the occupation of positions by night.

But the position several hundred yards in rear of a mask must not be invariably sought; it adds little or nothing of lasting advantage over the concealment afforded by positions immediately in rear of

crests, since they greatly hamper the free use of guns over the field of action.

Concealment must always be sought; get it naturally if you can, or get it artificially—but never at the expense of freedom of action.

While it is true that we must always look to our superiors for the assignment of a task that is definite and reasonable, the execution of that task will always depend largely upon the judgment we show in the selection of positions.

INDOOR TERRAIN FOR ARTILLERY TRAINING.

BY MAJ. ROBERT H. DUNLAP, UNITED STATES MARINE CORPS.

The device which is described and illustrated below was designed by me and has been in use by the Marine Artillery Battalion at Annapolis for some time. It is thought that it might be of general interest to field artillerymen.

In a recent edition of the *Journal of the Royal Artillery*. I noticed a device similar in nature. The one described, however, is somewhat more elaborate, and from about three months' service has proved a very satisfactory means for training officers and men in the proper nomenclature to use in giving commands, in the actual solving of problems, in the training of flank observers, etc., in the making of panoramic sketches and in testing out the same with fire problems involving the use of the data on the sketch.

The device is in the form of a skeleton frame excepting the bottom board, on which is placed, either behind each other or in prolongation, or both, several boards, to represent the profile of hills as seen at a distance.

Sliding on the two upper horizontal cross pieces (lesser dimension) marked "A" is a single cross bar made to slide forward and backward (as viewed from the observers position in front) without binding, by the arrangement marked "D."

This cross bar has two parallel slots cut in the direction of its greatest dimension in which slide two carriers marked "B" so arranged that there is no interference in passing each other. These carriers "B" in turn are slotted so as to permit two rods "C" to be elevated or lowered in a vertical direction as viewed from the observer in front. It should be noted from this arrangement that the little squares at the end of the rods "C," which represent the burst of shrapnel, can with respect to the terrain "E" be moved vertically up and down to represent angle of site or corrector; the amount to be moved, according to directions, is regulated by the scale on the rods "C." The burst can be moved, right or left, the indicated number of mils, by means of the carriers "B" in the slots of the horizontal bar "D," which is graduated in mils. Likewise the burst can be moved over or short with respect to the target, by reason of the fact that the horizontal bar "D" can slide backward and forward on the two upper horizontal cross pieces "A," one of which is graduated in yards. The scale used on "A" is 1 inch equals 100 yards; on bar "D" 1 inch equals 5 mils, on rods "C" 1 inch equals 5 mils.

Any convenient scale may be used, but this is satisfactory as now used.

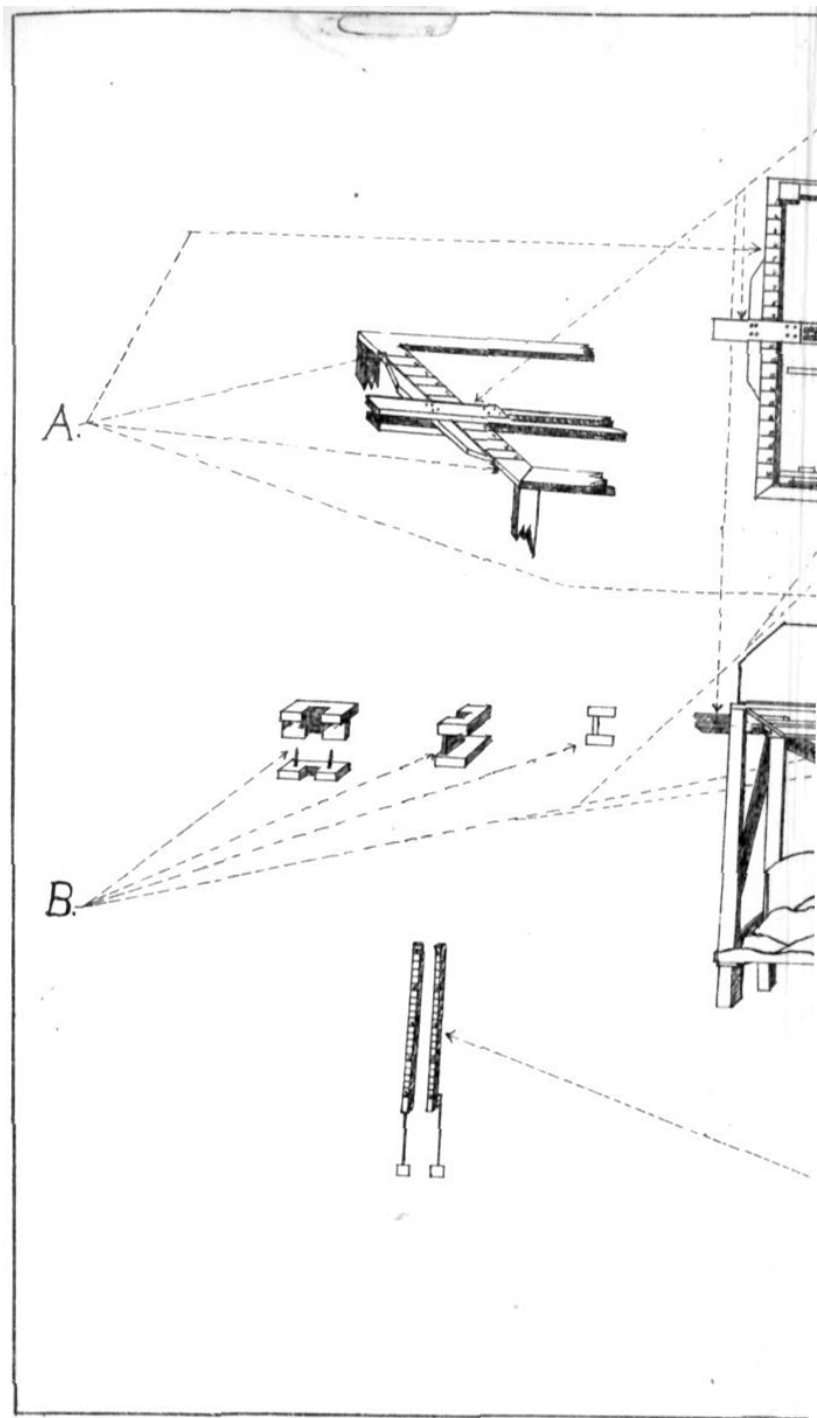
METHOD OF USE.

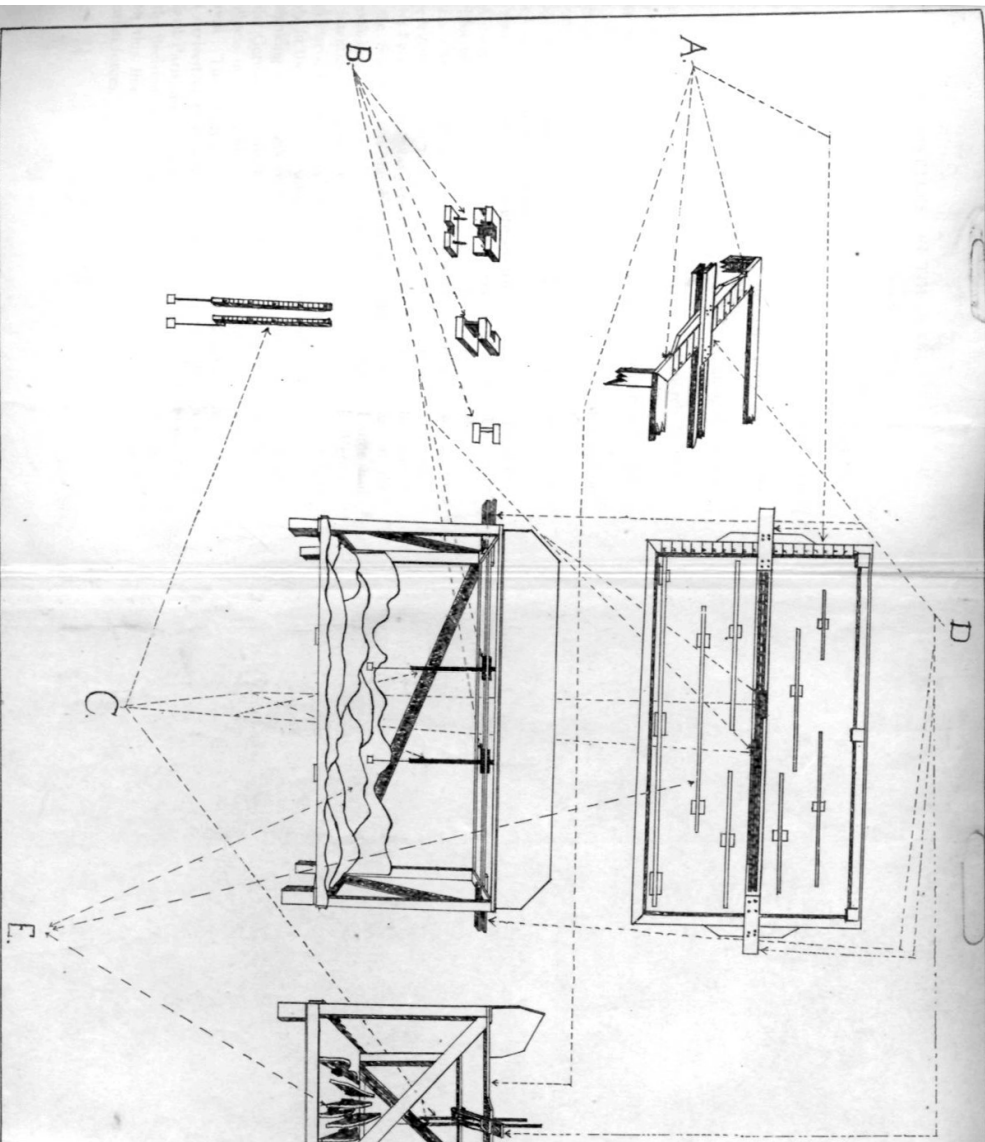
Suitable targets are indicated on the board terrain with chalk. The class is seated in front of the device with their eyes about on a level with the bottom board and at approximately 20 feet away. Any distance may be used.

Each member of the class in turn selects a target and in the proper sequence gives the necessary commands for opening fire for adjustment. The operator, standing behind the device, without regard to the site, corrector or range as given by the member of the class, selects and places the rods "C" at any reading of its scale, the carriers "B" at any reading on the bar "D" and the bar "D" at any reading on the yard scale "A" and then indicates by vibrating the rods "C" the order and position of the two bursts. The member of the class thereafter, by suitable commands, brings the points of burst until proper adjustment is obtained, when the commands for fire for effect are given, and the problem is completed. When the member of the class has made a change in his corrector scale exceeding 10 mils, the operator may assume that the site is incorrect, whereupon the member of the class changes his angle of site by 10 mils, and proceeds as before. It will be noted that the operator can indicate cross fire, or any degree of divergence of fire up to the limits of the device. Small electric bulbs placed in the ends of the rods "C" would be an improvement. In solving problems or in making panoramic sketches the class should be required to use battery commanders' rulers and to adjust the same to the scale of the device by shortening or lengthening the string until 100 mils on the ruler is equal to 100 mils on the scale of the device, represented to them by placing the two bursts 100 mils apart and then requiring the necessary calibration.

PANORAMIC SKETCHES.

The class should be required to represent the terrain of the device on a sketch, indicating all the targets (chalked on the terrain) and having completed same these should be tested by placing the point of burst on the registration point and noting the error (when using the data of the sketch), that occurs in bringing the burst to the various targets. In testing the sketches the bar "D" should be vertically over the target in question, the burst should then cover the registration point and from that position moved to the target.





INDOOR TERRAIN
 FOR USE BY THE
INSTRUCTIONAL PURPOSES
 OF THE
ARTILLERY CORPS
 FIELD ARTILLERY OFFICERS
 AT
 ANNAPOLIS, MARYLAND
 PREPARED BY
MAJOR A. H. DWIGHT, M.C.
 SOLDIERS OF THE
 1ST INFANTRY, U.S.A.
 28 APRIL 1918

THE BATTLES ON THE MARNE.

TRANSLATED BY 1ST LIEUT. EDMUND L. GRUBER, 5TH FIELD ARTILLERY.

From "Artilleristische Monatshefte" for March, 1915.

In the middle of August the German armies were placed as follows:

1st Army—Kluck, in Belgium, direction of march on Valenciennes.

2nd Army—Bülow, on the left of the 1st Army, astride the Sambre with direction of march on Maubeuge.

3rd Army—Hausen, to the east of the 2nd Army, along the Meuse, with direction of march toward the Oise.

4th Army—Duke of Wurtemberg, direction of march Neufchateau-Sedan-Montmedy, also toward the Meuse.

5th Army—German Crown Prince, direction of march on Longwy and vicinity.

6th Army—Bavarian Crown Prince, around Metz with direction of march against the front Verdun-Toul.

7th Army—Heringen, in eastern Lorraine with direction of march against Nancy-Luneville.

From these positions the German armies advanced in the directions indicated, in other words, on a very broad front. The result of these measures was that the French forces opposing them were within a very short time forced back more and more and a part were even compelled to retire behind the Marne. The left wing of the French forces was even in great danger of being surrounded on the Sambre. On the French side, the generalissimo of the French-English forces, Gen. Joffre, for some length of time had the intention of taking the offensive, supported on the line Verdun-Toul-Paris, in connection with which another army was to be held ready in the vicinity of Amiens in order to restrict and close in the outflanking movements of the Germans. But the rapid advance of the German right flank made it impossible to place this army in readiness in the vicinity of Amiens within an advantageous space of time. Those parts of this army which had already disembarked and arrived at this point, therefore, received orders to withdraw toward Paris, and the French commander-in-chief, therefore, came to the decision to draw up all his forces south of the Marne and from this line to make a general attack against the advancing German forces.

The reasons why the French and English did not succeed in halting the German invasion nearer the boundaries must be left for the future to clear up. It is claimed that a delay in the mobilization, or perhaps it would be better to say that the unexpected rapidity of the German mobilization, was the cause. Others have deduced that the withdrawal of the French and English forces was based upon a deep laid plan to entice the enemy as far as possible into France, in order to strike him with overwhelming forces from all sides and thus to completely crush him. But this latter design sounds rather fantastic and smacks too much of bar-room strategy. But so much is true, that it would be like the philosophy of the uninformed to inquire at this early date into the reasons for this conduct of the French and to interpret and to argue these things from every point of view. It is, therefore, best to be content with the bare facts.

In accordance with the principle of war that it is of first importance to destroy the enemy or at least to beat him so decisively that further resistance will be impossible, the army on the German right wing gave up its direct advance upon Paris which it had already begun. All the German armies, therefore, hastened with all their forces to the pursuit of the enemy who was withdrawing behind the Marne. Therefore, about the fifth of September, the German armies were grouped as follows from the right to the left flank:

1st Army—Kluck, direction of march on Meaux-Coulommiers, and in such a formation that it was able either to envelop the left wing of the French army or to make a change of front toward Paris.

2nd Army—Bülow, in the space between Montmirail-Chalons on the Marne.

3rd Army—Hausen, around Chalons.

4th Army—Duke of Wurtemberg, between the valley of the Aisne and Chalons.

5th Army—German Crown Prince, against the Argonnes, also between the Meuse and Aire.

The *6th* and the *7th Armies* were, in general, still in the positions mentioned above.

Opposing these German forces on the evening of the fourth of September the French-English forces were drawn up in the following order taken from the right to the left flank:

The *Army of Gen. Sarrail*, around Verdun and the heights of the Meuse.

The *Army of Gen. de Langle*, south of Vitry-le-Francois.

The *Army of Gen. Foch*, along the line Sezanne-Mailly.

The *Army of Gen. d'Esperey*, between Sezanne and Provins.

The *English Army, Gen. French*, in the vicinity of Crecy-en-Brie.

The *Army of Gen. Maunoury*, at the junction of the Oise and the Seine, covering the city of Paris.

The Allies, therefore, had at their disposal six groups or armies with which to make their attack upon the German advance.

The operations resulting therefrom developed as follows:

The armies of Gens. Sarrails, de Langle, Foch and d'Esperey attacked along the entire extent of their long front, the English army south of the Marne turned against the right flank of Kluck's army while Gen. Manoury advanced to the Ourcq and threatened his rear and the line of communications to the rear. Kluck turned against Manoury. This maneuver permitted the English by changing direction to the north to turn against his left flank. The army of d'Esperey on their right supported the English in this maneuver and also drove a part of the army of Bülow back across the Marne.

On the eighth of September, Gen. Foch, who up to this time had succeeded in holding his front, also went forward to the attack. East of La Fere-Champenoise he encountered the Guard Corps and three other German corps compelled them to withdraw across the Marne and to retire as far as Reims. At the same time Gen. de Langle moved forward and occupied Vitry-le-Francois and placed himself on the same line with Foch. In all these maneuvers the movement of one group or army had disengaged and supported the other: d'Esperey the army of Foch, Foch the army of de Langle. Gen. Sarrail, although seriously threatened on his front and right flank, nevertheless was able to maintain his position at Verdun, and the entire maneuver was made possible by the resistance offered along their entire front by the armies in Lorraine at that time under the command of Gen. Pau.

That in a nutshell is the course of the campaign and the battles which have now received the name of the battles on the Marne. There is no use in going into details such as movements of particular corps or divisions, or to discuss the points reached after each day's march. And it is just as useless to investigate the different shifting forces within single groups or armies. All information that we may

bring to bear in this respect still has the stamp of vagueness and is not definite. We merely run the risk of creating operations which as a matter of fact, never took place. This description, as already stated, has only one purpose and that is to give a very general outline of the events. One may, therefore, be excused from digging down into particulars and the painting of small details.

The result of the battle on the Marne was the general withdrawal of the German forces nearer to the boundaries. Many reasons have been advanced in explanation of this withdrawal. Some state that it was due to the fatigue of the troops caused by the long and rapid marches which they had made. Another report has it that the fault was due to the complete confusion in the line of communications, and that the impossibility to arrange an adequate and orderly flow of supplies had compelled this movement to the rear. But our conclusions had also better await the future report of the field operations, rather than to waste our time in the dark by collecting a lot of possible but still incorrect suppositions.

Early in October the opposing forces faced each other on a front of about 400 kilometers in length extending from the Somme toward Toul about as follows: From the Somme at a point east of Amiens to the Oise at Noyon, direction about from north to south. From here to Varrennes east of Verdun, that is twice crossing the Aisne and passing north of Rheims and Soissons, general direction being southeast. From Varennes in a curve around Verdun to St. Mihiel on the Meuse, and from here in an easterly direction to Pont-a-Mousson. From the latter point again in a southeasterly direction to the center of the Vosges Mountains and from here almost directly south to the Swiss frontier.

(Allgemeine Schweizerische Militarseitung.)

THE SELECTION AND TRAINING OF NONCOMMISSIONED OFFICERS.

BY LIEUT. JOSEPH ANDREWS, 1ST FIELD ARTILLERY.

Lecture Delivered at School of Fire for Field Artillery. Spring Term, 1915.

In the following discussion of a subject upon which probably all officers of experience have put much thought and study, it is not the intention of the author to criticize, either directly or indirectly, existing methods of attaining the desired efficiency. Experience has proved many existing methods satisfactory; and the present purpose is merely to suggest a means by which the selection and training of the noncommissioned officer may be standardized.

The noncommissioned officer has been fittingly called "the backbone of the army," and the selection and training of men to hold this office is as important a matter as the military mind can conceive. Considering the nature of his duties and his responsibilities it would seem that thorough preparatory training before entering upon the performance of his new duties is highly desirable, not only in the interest of efficiency but also in order that the work required of him may be better understood and made less difficult for him.

The necessity for a uniform system of selection and training arises from the fact that, owing to the different methods employed by the various battery commanders and the resultant imprint of their own individualities upon the work performed by their noncommissioned officers, it is extremely difficult, if not impossible, for an officer other than the regular battery commander to take command of a battery and obtain the maximum efficiency of that battery until he has been with it long enough to familiarize himself with the degree and kind of training that the noncommissioned officers have attained, which in many cases differs radically from his own ideas on the subject. The length of time required for the work of the battery commander and that of his noncommissioned officers to become coordinated depends upon circumstances and the adaptability of each.

In time of war it will no doubt frequently be the case that officers will be assigned to the command of organizations that they have not even seen, and it would be unfortunate if, during active operations, the foregoing condition should obtain. It is, of course, impossible

to eliminate entirely the personal element, but in so far as practicable, it appears that it would be desirable to do so. At least it seems that some uniform system of training might be adopted by which the noncommissioned officers would be so trained that a new battery commander would know what to expect from his noncommissioned officers as to the extent of their training without having first to learn the man.

There is no doubt that many battery commanders have their organizations in a high state of efficiency through their own methods of training their noncommissioned officers, and that the personal knowledge of the battery commander of the particular qualifications of the several noncommissioned officers has contributed largely to the efficiency of the battery, but it will probably be exceptional when the same officer commands that battery through active operations extending over any considerable period of time, and in view of this fact it is necessary that the battery be so prepared as to admit of its being taken over by a new battery commander without a temporary material loss of efficiency.

Then, too, a battery may be likened to a machine and in active service owing to losses it will be frequently necessary to replace "parts." and it is very necessary that proper "spare parts" be accessible.

Aside from the efficiency of any particular battery another important feature enters. At the outbreak of war a great increase in the amount of field artillery must be provided, and it is to our noncommissioned officers, together with the comparatively few National Guardsmen that we must look to, to provide officers and furnish instructions to the augmented Field Artillery. Thus it appears incumbent upon us not only to train thoroughly a considerable number of men for the purpose, but, by constant work to keep them in training against the need for their services in other than their own batteries. Thus it appears that in times of stress we must have a sufficient number of properly trained men, in order to have the least hope of success.

On the other hand let us consider a condition which frequently occurs in peace time. In certain regiments which are situated in undesirable localities, or in which the duty is particularly disagreeable, men are not prone to reenlist and it sometimes happens when all the experienced noncommissioned officers and privates of an organization have been discharged the battery commander is forced to select

as his noncommissioned officers men who on account of their limited service have had little experience and no particular instruction or training. It may be readily seen that this condition seriously impairs the efficiency of the battery.

Granting the desirability of a high degree of training and the necessity for uniformity therein, the next consideration is that of the manner or method by which the same might best be secured.

It appears that a school in which every man would have the same instruction, might be the surest means for accomplishing the end in view. From the standpoint of numbers, as well as that of geography, it is obviously highly impracticable to have all candidates for the grade of noncommissioned officer attend the same school. Naturally the first question to arise is that of the number of location of the schools or of the central school and its branches. Everything considered, it seems that it would be best to have a branch in each regiment or separate battalion. In the event of a battery serving alone the candidates therefrom could be sent to the nearest regimental or battalion branch.

A brief outline of such a school follows:

The instructors would be officers chosen by the regimental commander for their qualifications in the particular subject or subjects, assisted by noncommissioned officers, preferably graduates of the School of Fire. In this manner the best available instructors could be selected, and their work so arranged that it would not be especially arduous or interfere with their usual duties.

The personnel of the class would be composed of men recommended by the several battery commanders for their special qualifications, as under the present system of appointing noncommissioned officers. It is assumed that the candidate will be thoroughly instructed as a private and has, moreover, been in the service a sufficient length of time to be perfectly familiar and accustomed to his ordinary duties, before being recommended to attend the school. His qualifications should, naturally, be decided by the officer recommending him. It would be preferable, however, that these men be selected as early as practicable in their current enlistments in order that the service might get the maximum advantage from their services after completion of their instruction.

During the progress of the course a strict record of the work of the men in the various subjects would be kept, and careful observation of each man taken, as to his general worth, which we will consider

later under the heading "Aptitude." If at any time, during the course through misconduct, neglect or otherwise, a man should be found incapable or unfit for advancement to the grade of noncommissioned officer, he should, upon recommendation of the instructors, be sent back to his battery.

At the end of the course the instructors, acting as a board, would average the marks obtained by each man in the several subjects, and each instructor submit his marks of the candidate on aptitude. In this way the board would determine the man's relative standing and recommend him as being proficient or deficient, as the case might be, noting in the recommendation any special qualification or marked ability displayed by any man. Upon such recommendation the regimental commander would appoint the men in order of merit as vacancies occurred in the regiment.

It is believed that in this way, in most cases, the newly made noncommissioned officer would be appointed and assigned to a different battery than that from which he came and in consequence would enter upon the performance of his duties thoroughly instructed and lacking any partiality due to previous affiliations and friendships.

The number of men sent to the school from each battery for each course should be not more than five nor less than three, if practicable. Under present conditions it would probably not be practicable to send this number, but additional strength might well be provided. With this number the class would be sufficiently small to insure proper instruction of each member, and at the same time be large enough to provide a number of qualified men to fill all vacancies likely to occur.

It should be understood that the school would not attempt to turn out perfectly trained men, but would so instruct them that they would be able to take intelligent advantage of their experiences and observations and to improve themselves, with further instruction under the battery commander.

In selecting a course of instruction, it should be remembered that the principal value of any particular knowledge is in the ability to apply it, and in our choice of subjects we will consider only those subject or parts thereof that will be of practical value, in strengthening the "backbone of the Army." A writer once very aptly likened the human mind to an attic, in which knowledge is stored. Although all knowledge is good, we should consider it a waste of time and capacity to burden a man's mind with information which he will not be called upon to use. For the foregoing reasons, and in view of the

choice of subjects, the instruction will be chiefly practical with just enough theory to fix the various points in the student's mind and give him a clearer comprehension of them.

In such a course, the following subjects are suggested:

1. Drill Regulations, including study of various pamphlets published by and in use at the School of Fire.
2. The service of communication, including oral messages, flag (semaphore and wig-wag), telephone and buzzer. Qualifications for speed and accuracy as required at School of Fire.
Detection and repair of common faults in telephone and buzzer.
3. Topography, map reading, including determination of firing data from map. Oral description of features of the terrain, and route to be followed from one point to another.
4. Instruments, use, care and common adjustment of range finder, scissor, aiming circle, battery commander's telescope, panoramic sight, range quadrant. Speed and accuracy qualification as required at School of Fire.
5. Construction, operation and care of matériel.
6. General principles of draft (or pack), including adjustment of harness (or pack).
7. Hippology, principally care of animals, common diseases, and injuries, how sustained and how treated.
8. Equitation, riding and elements of horse training for riding and draft purposes.
9. First aid, hygiene, sanitation.
10. Instruction of recruit.
11. Aptitude.

Each student should be provided with a copy of Capt. Moss' "Noncommissioned Officers' Manual," and required to read it and be able to answer questions concerning the contents.

To obtain the best results in the course as outlined it is believed that not less than six months should be devoted to it, the time to be allotted to the subjects in the following order:

First two months, daily (except Saturday and Sunday). Subject 8, one hour; subject 1, two hours; subject 6, one hour; subject 7, one-half hour; subject 9, one-half hour.

Second two months, daily (except Saturday and Sunday). Subject 8, one hour; subject 10, two hours; subject 3, one hour; subject 2, one hour.

Third two months, daily (except Saturday and Sunday). Subject 8, one hour; subject 4, two hours; subject 2, one hour; subject 5, one hour.

Saturday mornings during the course, a short talk to the class by an instructor on field artillery subjects of general interest.

The foregoing program is given as a mere outline of the minimum amount of time to be spent on the different subjects, in order to realize the degree of proficiency desired. Local conditions might necessitate a considerable number of changes in arrangement and for this reason it is not practicable to submit a detailed program.

The mark on aptitude should be given a weight of about one-third in determining the man's final standing. For although a man might be able to complete the course satisfactorily in regard to the several subjects, he might for a great number of reasons be unfit to assume responsibility or to exercise authority.

It should be constantly borne in mind, particularly by the battery commander, that not only is initial training necessary but also that to accomplish results it must be followed by constant practice in order that a working knowledge may be maintained. In other words it is necessary "to keep one's hand in." For instance, it accomplishes very little direct good if a man becomes qualified in the use of the buzzer and is not called upon to put his knowledge into actual practice for a considerable period of time. Since it is constant drill that trains the mind and body to a state of proficiency, neglect or lack of use leads to forgetfulness. After three months or more, depending on the retentiveness of the memory of the particular man, if he has left the school proficient in the work with the buzzer he may have lost his proficiency, and if in an emergency he be called upon to put the result of his training into practice, he is likely to perform the duty in an unsatisfactory manner. In other words not only training but daily practice must be had.

The reader of this paper will be struck, no doubt, by the similarity of the course outlined to that of the noncommissioned officers' course at the School of Fire. Except for a few modifications and additions it is practically the same. Now if such a school as has been described were established, it might very well be considered a preliminary branch of the School of Fire and men who showed marked aptitude and ability might be sent to Fort Sill and there undergo a more advanced course with a view to preparing them for appointment as officers when circumstances should require it. Names and addresses of qualified men should be kept by the War Department.

To cover completely a subject of this scope would require much more space than is available. For this reason it has been necessary to prepare simply a rough outline of a suggested method, the value of which can be determined only by a service test.

INSTRUCTION OF THE FIELD ARTILLERY IN THE NATIONAL GUARD.

MAJ. H. M. BUSH. FIELD ARTILLERY, OHIO NATIONAL GUARD.

It is not the purpose of this article to propose any definite or general scheme for the instruction of the National Guard Field Artillery. It will rather be attempted to call attention to some of the difficulties in the way, the errors and mistakes commonly made, to explain and maybe apologize for some of them, and, if possible, point the way for better results in the future. It should be understood at the outset that there is no intention of crying *pecavi*. We have undertaken the task and we must see it through or give way to others who may be in better position to get satisfactory results.

Before attempting to discuss the subject of instruction it is advisable to call attention to the various factors entering into the problem and to point to the fact that, in addition to the eternal human factor, almost if not all of them can be classed as variable; their relative value being as variable in different localities as any of them separately. No attempt therefore is made to arrange them in any order of relative value.

They are as follows:

- | | |
|---|--|
| (a) Lack of military sense in the nation at large. | (g) Obstacles to discipline. |
| (b) Liberty and freedom (license). | (h) State support, finances, armories. |
| (c) Local apathy or hostility. Local sympathy is usually lacking. | (i) Mounted instruction. |
| (d) Recruiting. Small organizations. | (j) Antipathies and ignorance. |
| (e) Irregular attendance. | (k) Officers. |
| (f) Short enlistments. | (l) Short drills and camps. |
| | (m) Lost motion. |
| | (n) Instruction. |

It is possible to use up the whole alphabet in enumerating the factors necessarily entering into the solution of our problem; but the foregoing may be regarded as being more or less generally typical.

Let us therefore discuss each one as briefly as possible.

Lack of Military Sense in the Nation at Large.

No nation which seeks to interpose sentiment, idealism and politics as a counterpoise for ships, guns and trained men or which proceeds on the assumption that military training is not necessary for the handling of arms and bodies of armed men can be said to have military sense.

Our whole history is a series of military blunders, covered over and lied about in our histories, by our teachers and politicians, and only changed from total disasters by the fortunate interposition of distant and distinct factors coupled with our happy geographical location in a day when distances had not been overcome. From these experiences we have deduced a false theory leading us to believe military training and preparedness to be unnecessary. The great bulk of our people firmly believes that we alone of all the nations of history can set experience aside and trust implicitly in the untrained volunteer. We therefore act accordingly in our treatment of all things naval and military.

Liberty and Freedom (License).

The extent to which this shibboleth of the American people is abused or taken advantage of to the detriment of "good order and military discipline" as well as the maintenance of law and order from a civil standpoint is bad enough among our heterogeneous and undisciplined population. That the same feeling should permeate the National Guard to a certain extent is only natural. The extent to which it affects the progress of instruction is the most serious feature. Inspector-instructors and commanding officers of regiments and battalions, and even governors, acting through their adjutant generals, find themselves face to face with almost open insubordination. Take our correspondence schools for example: Officers in whom the habit of concentration and study have either never existed or have been so disused through the years since they left school that the mere words study and examination present insurmountable difficulties, will, with the utmost nonchalance, announce they are too busy to send in papers. Often they fail even to confer with their immediate commanders and secure approval for their neglect. It does not strike them that they are really taking part in a mutiny or conspiracy to limit the amount of training and education known to be necessary for all officers. From an avoidance of the correspondence school it is an easy step to the evasion of other requirements and even to the open disregard of orders.

Under the same plea (business affairs) ordinary correspondence is neglected, returns are delayed, and every detail of supply and administration hampered and disjointed. These officers do not intend to adopt this attitude and are always much perturbed when

they are called to account for their shortcomings; but they have grown up in the habit of considering their own personal likes and conveniences as being paramount and when they come into the realm of military administration they fail utterly to appreciate their duties and responsibilities. It is easy to say that such officers should be gotten rid of; but officers of even mediocre ability cannot be picked up at any cross-roads and until the offenses become unbearable or efficiency seriously impaired the "lost motion" due to this liberty of action continues. In passing judgment in these cases we have also continually to bear in mind the outstanding fact that officers and men must make a living besides.

Local Apathy or Hostility.

The judge who will sentence a thief to enlistment in the Army or Navy; the politician who will propose to compel members of the Army or National Guard to labor on the public highways; the labor leader who seeks to cripple the National Guard in every way known to him; the employer who forbids his employees to enlist or penalizes them for so doing; the parent who looks upon the Army and the National Guard as the worst place for his or her son, forgetting to note that he is becoming more expert in handling the cue or the dice than he is the tools of his trade, if he has one; the anarchist who seeks to destroy society and the pacifist who would, in theory, block an invasion with an invitation to eat and talk it over are all of them hostile to the maintenance of a military establishment. They exist in every community in greater or less numbers. Their propaganda must be personally combatted by the National Guard officers before headway can be made. Next door to these "patriots" lives the man, usually a "business man," who believes in the Army and the National Guard, particularly the latter; but he cannot be induced to send his son to enlist because it might interfere with the young man's future. Just across the street lives a man who is a firm believer in the "every American is a soldier and only needs the call to arms to prove it." He knows little or nothing about military affairs and cares less. All down the avenue we find similar conditions; except in a house on the back of a lot there lives some young fellow with red blood in his veins and a glimmering of "military sense," and one day he enlists. By luck he tells some friend of it. The friend stops and stares at him and says: "You

don't mean to say you have done that," or else curses him roundly for treachery to the "Laboring Classes." Is it any wonder recruits hesitate to present themselves, or that men already enlisted grow indifferent?

Recruiting. Small Organizations.

Once in a great while we hear of an organization in the National Guard with full ranks, but where we find one in this condition we find a hundred and fifty in dire need of men to fill up to the required minimum. Before we can accomplish very much in the way of training a battery the captain must first get the battery personnel. Combatting him he has all the elements enumerated under (c), the utter indifference of the average youth to things military, coupled with a great fear of a little dirt, hard work and getting hurt. What attractions can a really earnest battery commander offer a young man compared with joy rides in automobiles, vaudeville performances, the "movies," dances, and the pleasant hours in the pool room or holding hands on the porch?

The solution of this problem is more likely to bring gray hairs and a wild look into the eyes of the National Guard battery commander than "P-T" or the "drop back" possibly can. On the recruit depends the chance for the battery commander and his officers to learn the technical details in a practical way and under satisfactory conditions. In the past twenty-one years the writer has spent more time on this problem than he has on all the rest combined, and he is no nearer a solution now than he was when he started.

How to get sufficient recruits and make the organizations permanently larger remains to be solved either by a revolutionary awakening of public sentiment under stress of national peril, or compulsory service arising from the same source. The first will be evanescent, the latter apparently improbable under present conditions.

Irregular Attendance.

Of all the stumbling blocks to any scheme of instruction, no matter how carefully thought out or how flexible, the irregularity of attendance at drill in the majority of all our National Guard organizations is probably the greatest. In every organization there are certain standbys who can always be relied upon to answer the roll call; but the instruction of these men is seriously curtailed by the time

spent in helping the casuals up to the point where they can "muddle through" the drills. Do what he can the battery commander is always face to face with the problem of operating a machine only partially complete, and the system has yet to be discovered whereby all the men can be given the very modest amount of seventy-two hours, (nine 8-hour days) drill and instruction per annum. If all the men do not appear for instruction at every drill the force and value of any preconceived scheme of instruction is depreciated in just the ratio the non-attendance bears to the total necessary to operate the machine successfully. To compute this ratio we must take into consideration each individual case of absenteeism and not work on averages of attendance. A few well attended drills on special occasions will run the average way up, but the specific or total instruction imparted at these special occasions may be relatively or actually very small. The answer to our problem in this case might possibly be worked out in averages of instruction; but it would be more accurate if given in terms of totals of instruction per individual per organization. In other words: With ninety men as the basis of a working battery, what is the percentage of instruction imparted in a year to the whole with an attendance of ten men making 100 per cent., ten making 80 per cent., ten men making 70 per cent., and so on until we come to the fellow who puts in a smiling appearance once in two months or less. The writer confesses his inability to solve the problem for the reason that the several other factors entering into it are all variables and the personal equation of each individual and the scheme of instruction adopted must also be considered.

Short Enlistments.

Just what the average period of enlistment actually served throughout the National Guard is, the writer is unable to say; but in his experience a year and one-half measures the average length of service. Just think of it, a maximum of about 200 hours of instruction in homeopathic doses from enlistment paper to discharge certificate, and maybe that modest amount is cut down very materially by absenteeism! A progressive scheme of instruction soon falls to the ground when recruits compose the major portion of the attendance at drill. Recruits have to be hurried along and much of their elementary instruction slighted or neglected in order

that those faithful few who "stick" may not be discouraged by "not getting on the guns."

Obstacles to Discipline.

For the sake of argument we will assume the laws of the various states give commanding officers ample authority to punish refractory members of their commands; but these laws are too often subject to interpretation by judges who look on the National Guard as a form of play; or who are more prone to allow legal niceties to carry than such a foreign and dangerous thing as military discipline. Again the battery commander has always to remember the yellow press in his city is looking for a "sensation" and his men have to earn their livings outside of their military work. A "sensation" in the local yellow sheet will hurt recruiting for a long time to come, while the reputation he establishes for discipline stricter than some predecessor or another local organization will last still longer. The net result is he grits his teeth, kicks the bottom of his desk and gets rid of the offender as quickly as possible, his dream of enforcing discipline shattered and offered as a sacrifice to the recruit fetish. As a whole the writer believes our average discipline today is far better than it has been and possibly superior, if he has been told aright, than it was among the volunteers in the sixties; but even then it leaves much, very much to be desired.

State Support. Finances. Armories.

In some states the field artillery has little to complain of but there is little or no assurance that what we have today may be cut off tomorrow. The states feel that the demands made upon them for the support of the field artillery are becoming too heavy as compared with the use the state can put them to. With one state contemplating the disbandment of its Guard for lack of means and several others cutting down their appropriations we have a situation that makes men hesitate about offering armory facilities or going to the expense of taking commissions.

When it comes to the question of financial support it is almost always necessary to obtain money by subscription or assessment on the members. Some few commanders have money thrust upon them; some few have means of their own to squander; some few have ample support from their state; but the great majority have to get out and hustle for the funds to pay for mending the harness

broken at last camp or mounted drill. In civil life men go to the insane asylum or the penitentiary over matters pecuniary, and the national guardsman must first of all earn his living and then hustle to keep his battery from dying of financial starvation.

When he is not worrying about his finances he is very possibly in a fever over his armory. From armories having the sky for a roof to those costing a million or two is a far cry, yet we have them all. The better the workshop the better the class of work done therein is a reasonable supposition; but the battery which has apparently everything that is needful should not look upon those who have not as being utterly, hopelessly handicapped. The initiative and resource necessary for the battery commander who has nothing and yet is able to show some results will stand in better stead in the field than will the training given where everything is ready at hand. For certain features of our training the large well-equipped armory is a great assistance, but it must not be taken for granted that it is everything. The battery drilling in the snowstorm or rain as a matter of necessity will accustom itself to field conditions a trifle more readily than will one which has been brought up almost entirely indoors. To evolve a scheme of training to suit all conditions and at the same time produce uniform results is another phase of our problem.

Mounted Instruction.

Some batteries have a few horses, some have none they can call their own. As a broad general proposition we have none and until we do we are practically useless. Stringing or draping harness on a wooden horse or dummy is a different proposition from putting it on and fitting it to an actual horse. Our short camps tend to give us a false idea of what would happen to us were we to be sent into the held and required to use our horses for weeks at a time. Many of our batteries which get along fairly well in the usual eight or ten days' camps would be immobilized in a month. Promised federal aid will help a great deal but even the number of horses provided for (thirty-two maximum) will not give us the training demanded of a battery ready for field service.

Antipathies and Ignorance.

The attitude of some higher officers and other arms cannot but fail to have an injurious effect. The less said on this score the

better. But that such a state of affairs exists is undeniable and disgraceful; but the necessity for armies comes from the petty hatreds and jealousies of men and the best we can do is to counter them with the exercise of all the patience and common sense we possess.

Officers.

Under the conditions obtaining it is not always possible to select, by election or in any other way, men having the special and general education to enable them to approximate the standard set by the officers of the Regular Service. Our first desiderata for an officer very often narrow down to the finding of the man who can afford to give of his time and means to the work. Once in a while we find a man able or foolish enough to sacrifice both. Added to this he must be in a position to secure at least a measure of local financial and moral support. In most cases his technical qualifications are overlooked and he is trusted to study up to his position after he has attained it, if he has the time from his other duties and problems. If the officer has been fortunate enough to have received a collegiate education he may be able to acquire the rudimentary portions of his technical requirements in a year or possibly two. If he then can avoid the mistake of getting too well up in the "high brow" class, he stands a good chance of making good, provided he is a good leader of men, and is able to stick it out. If, on the other hand, he has none of the advantages of the higher education, but has made his way in spite of the handicaps, he is just as likely to remain too elementary as he is to gravitate toward the "high brow." The successful mean is found in the man who can be both at once and combines with his knowledge and practical experience the faculty of handling men.

No attempt will be made to classify the only too common individual who so often arrives at a commission in the National Guard, whose "military sense" ends with the selection of a uniform and the wearing of it on all possible occasions; but whose technical and administrative ability is so limited that he would find difficulty in keeping order and discipline on a desert island with himself the only inhabitant. These individuals are long on troubles and complaints, never by any chance get things right and, strange to relate, are amazingly hard to get rid of quickly and quietly. We have them and that is a sufficient evil.

For the work of the field artillery, men who have had engineering training, and have been taught that they have a whole lot more to learn by experience than they have been taught in school or college, should make the best material for officers. Such men are hard to get as they are in demand by commercial concerns and after they have made their start the demand on their time and energies are so insistent they find it impossible to hold up their ends. If such men can be obtained while still in college they will give temporary service; but they graduate at just about the time they have become valuable and in most cases have to leave the National Guard.

Short Drills and Camps.

Considering a battery as a machine in which each individual man is a component part we cannot expect to attain any very high degree of efficiency when only a fraction of it can be put together each time it is desired to operate it. With all machines having any number of moving parts it is always necessary to erect them and operate them for a longer or shorter period on the testing floor in order to insure smooth running. A machine works, without its testing department, would soon be in the hands of the sheriff through the failure of its product to operate without trouble in the customer's hands. To be of any value, our batteries must be frequently operated as a whole and long enough at a time to enable the battery commander to search out and correct all the little faults. Even supposing we have the maximum attendance we are capable of at each drill, are one and one-half or two hours a week long enough? It we go back to the parallel case of the machine on the testing floor we find eight and even twenty-four hour runs are necessary. Our seventy-two hours per annum looks pretty small in comparison.

If we take the individuals composing these batteries and compare them to the men composing the working force in our machine works we find it takes three years, as a general rule, for a boy to learn a trade. This requires his working, under the minimum hours established by the labor unions, forty-five hours a week, or a total for his apprenticeship of 7,021 hours if he works every day. On this basis of forty-eight drills of one and one-half hours each per annum and eight days in camp, average of eight hours drill and instruction, we have the magnificent total of 408 hours in the same period of time (three years) or a little less than 6 per cent of the

time allowed for the apprenticeship in the simplest trade. We will not be willing to admit that it takes more brains and instruction to learn to lay bricks, nail lath, or run a turret lathe, for instance, than it does to learn the duties of a field artilleryman in such a manner as to make the product acceptable to our inspectors. In fact our requirements for proficiency are really more severe than those of the average journeyman in any of the more common trades. How, then, do we expect to secure results on so much smaller an expenditure of time and effort? Is it not possible many of us are deceiving ourselves as to the results we are accomplishing or are our ideas and methods of trade instruction so entirely wrong? We are agreed on the value of military training and the efficiency resulting therefrom; but are military methods so much more superior to accepted civil methods that we can accomplish equal results in but 6 per cent. of the time? Certainly the experience of the Regular Army does not give us reason to believe this to be the case. What percentage of real efficiency therefore can we expect to attain when we devote so little actual time over a period of three or even ten years? We may be able to train a certain grade of men to a sort of letter perfect performance of their duties; but if we have a better grade they are more apt to realize their deficiencies and show in their hesitation and inaptitude their consciousness of it. Are we then to consider that the duller mind makes the better soldier because he can be drilled into seeming efficiency?

Lost Motion.

How large a proportion of our 408 hours of training is taken up in starting and stopping? How large a proportion is taken up in the innumerable movements resulting from inexperience, lack of system, crowded locker rooms, absentees, late comers, the fellow who has mislaid some part of his uniform, lack of proper facilities and above all and responsible for most of it, the lack of firm, continuous control our short periods and loose hold on the men produces? A recent test, made under stop-watch conditions in a certain organization, disclosed the fact that an average of thirty minutes was lost at both ends of each drill in the locker rooms. A further test showed that ten minutes at each end was sufficient in every case and produced more order in the lockers than had hitherto been obtainable. In this way forty minutes of valuable time was gained

and the drills lengthened from two hours to two hours and forty minutes. The men were more pleased than the officers.

At all our drills time is lost in rearranging sections weakened by absentees and lack of recruits. In camps time is lost through lack of suitable transportation, green horses, unfitted harness, and a hundred and one other minor details. If we were to figure out in dollars and cents the cost of our instruction in camp per hour per individual and if possible add the amount lost by each individual as the difference between his civilian and his military pay we would be appalled at the figures.

Instruction.

Although the presence of inspector-instructors on occasional visits and the work of the sergeant-instructors have done a very great deal toward standardizing and bettering our discipline (instruction), nevertheless the methods of instruction present great variations in different batteries.

The schedule of instruction suggested by the Division of Militia Affairs (Cir. 3) is splendid under favorable conditions; but it breaks down when confronted with irregular attendance, small numbers and some of the other factors enumerated above.

As has been suggested there is a tendency to crowd too much theoretical work into the training. On the other hand the instruction can be made so continuously elementary that the best men become disgusted and noncommissioned officer and officer material is hard to develop properly, if at all.

Where an attempt is made to balance the instruction there is always trouble in getting it to "stick." With the drill periods as they are, it is rather remarkable we succeed in getting the results we do. Interest and enthusiasm are the only assisting factors, but these will not make up the deficiency.

With the recruit problem always uppermost in his mind, and inspection or camp drawing near, both officers and men are anxious to get on the guns and something has to be dropped.

The battery commander will argue, with considerable show of reason, that he has not the time to instruct his men in everything in the time allowed and perforce he is justified in neglecting those things which seem to him to be at least important, but in which he falls down heavily on inspections.

The work of the year centers about the eight or ten days in camp. Officers and men look forward to the camp as the one time in the year when they can really feel they are accomplishing something in the way of training. The old precise movement and parade idea is dead in most organizations and has to be kept buried in order to reconcile the men to the hard work we fill their only vacation with. In camp horses enough to go around are available and possibly target practice can be had. The entire work of the year centers around the camp and other things are found to be irksome and are therefore pretty sure to be neglected. The men, especially the more intelligent and active, have their native restlessness and desire to go-ahead-and-pick-up-the-pieces-afterwards spirit born and bred in them urging them on, and they are very apt to lose interest altogether unless they are satisfied. The hold on them is too slender to drive them altogether against their wishes. The battery commander therefore finds it necessary to swing in the tide and the result is hasty and superficial instruction. If he does not sense the sentiment of his better grade of men, interest falls off and the battery deteriorates either in the quality of its personnel, in numbers or both.

Whatever the course of instruction given the battery, there will always be men who will not or cannot attend drills regularly; there will always be men applying for discharges or leaving town, either in search of employment or in the course of it; there will always be partially instructed recruits thrown into the sections before they are ready, in order to fill the places of absentees. If the recruits would only come in bunches, their instruction would be much better and not so haphazard; but with one or two a week it would take all the noncommissioned officers to give them progressive instruction and the other men and the battery drill would suffer accordingly. As it is, so much of our time is devoted to instructing recruits that it seems to us older officers as though we had never done anything else.

No course of instruction can apparently be arranged which will provide for all these contingencies absolutely and the results, or rather, the lack of them, show most glaringly when they are least wanted.

In the face of these difficulties, the real value of the National Guard as a possible fighting force, without a great deal of additional training, cannot be very great as compared with the regular troops of this or other nations. It is the best we seem to be able to produce

with our fatuous lack of any military policy and the tremendous prejudices against increases in the Regular Army.

If a portion of the difficulties could be removed, more of the time of the officers now given to recruiting, administrative details and keeping alive the organization, could be devoted to instruction with a considerable resulting benefit.

As far as the great bulk of the enlisted personnel is concerned, the training received will hardly suffice to give them much more than a superficial knowledge of their duties, field conditions considered. The balance gradually learn the more rudimentary principles and even arrive at a good degree of proficiency. The very conditions under which they have learned what they know, be it little or much, are not such as to give them that habit of instinctive action under all conditions so necessary in the work of the soldier.

It is true, the individuals would, in time of war, pick up this knowledge and habit quite rapidly and they would, without doubt, be far more valuable than entirely raw recruits. As organizations, batteries, battalions and regiments, the present small sizes, averaging only about 50 per cent. of peace strength, militates most strongly against them. Immediately on the outbreak of a war, the injection into them of large masses of entirely untrained men would render them well-nigh useless. This training would of necessity devolve on the partially trained officers and men in all but a few instances the National Guard batteries could not be gotten ready to do effective work in the field at the time of the greatest need.

Our shortage of trained officers and men can be satisfactory only to an enemy or the most ardent pacificist. Not less than thirty new regiments of field artillery will have to be provided if the rather modest plans of the General Staff are ever put into effect, or on the threat of war; with the added necessity of providing a reserve to fill the gaps occasioned by conflict.

From the inspection reports of 1914 we find we have three regiments; ten battalions and nineteen separate batteries organized as such in the Guard. There were reported 303 officers of all grades and 4,700 enlisted men present at inspection. The desired peace complement calls for 398 officers and 9,398 men, giving us a shortage in the actual organizations of ninety-five officers and 4,698 men, without taking into consideration the additional officers and men necessary to form the scattered batteries and battalions into regiments.

The plan of the General Staff calls for twelve Militia regiments, requiring 312 lieutenants and 180 officers of higher grades. Of noncommissioned officers we would need 2,712 plus any shortage of officers existing at that time. For the forty-two regiments we will need 1,722 officers and 9,492 noncommissioned officers, or a total of 11,211. To supply these we would need practically all the officers and enlisted men now in training plus as many as could be gotten from the six regiments of Regulars. If these six regiments have to be broken up we must replace them, and the number of officers and noncoms necessary would be increased by their requirements. In other words, we should have 2,000 officers and 11,818 noncommissioned officers ready or in training for the first line alone, without allowing for any reserves or supply.

With the shortage existing in both Army and National Guard of both officers and noncommissioned officers, it would seem as though we were trying to do the impossible in more ways than one. We cannot supply ourselves even in our present 50 per cent. condition. What are we going to do when we are called upon to do that and then take care of the rest?

Further, are all our officers capable of not only acceptably filling their present positions but also of promotion to higher grades? If they are, we have some grounds for great satisfaction; if they are not, we should fearlessly say so and do all we can to better the situation.

If we are honest with ourselves, we cannot but acknowledge how inadequate for field service purposes our present training really is. Would it not be the part of wisdom to cease some of the pretence we are now guilty of and by frankly considering each of the present batteries, and those which may be created in the future, as practical training schools for volunteer officers of field artillery and attract to them as far as possible a class of men capable, by reason of their education and natural aptitude of performing the duties of officers and noncommissioned officers?

It would be desirable to maintain battery and higher organizations for the purposes of administration and tactical instruction; but instead of requiring that the entire equipment be kept at one place, sections and platoons could be located in different localities, to be brought together for organization training at stated intervals. We might then see what complete batteries looked like, a rarity now.

In order to carry out the plan of training, tests and examinations for officers could be given and certificates awarded. The life of active commissions could be limited and the holders of them placed either on the reserve list, subject to certain annual duties, or else assigned to staff duties and studies. The same could be done with the holders of certificates attaining a given standard of excellence or grade in their work.

It might be thought that our universities where military drill is compulsory would make ideal places for such instruction batteries; but the youth and inexperience of the students must be taken into account and not too much reliance placed in their staying qualities. (NOTE. The writer is a university graduate and speaks without prejudice, but only as the result of twenty-odd years' experience in handling the graduate and undergraduate in civil affairs.)

It is admitted the officer product of these training batteries would be inferior to that of the Regular Army and these batteries would not be available for instant service. On the other hand, the results would be immeasurably better than could be gained by the breaking up of our present National Guard batteries, few of which are at all ready for that same instant service. The record of the 7th New York, and the Artists' Battalion of England, in the present war, give us a very good indication of what could be accomplished in this direction if we could only say to the prospective recruit, there is a sure commission ahead for you if you stick and make good; instead of darkly hinting at the possibility, as we now have to do when a really high-grade man comes along.

To accomplish results as at present constituted, or in any other way, much more could be done were the control of the batteries to be single and not dual as it now is. With straight Federal control, service with Regular batteries for longer or shorter periods would be required or at least certain, instead of being by favor of two parties, as now.

It would, of course, be necessary to make changes in the laws and possibly the Constitution, and it might be difficult to get the necessary measures put into effect, unless the present sentiment and temper of the nation is wonderfully changed.

In the meantime, we cannot afford to be idle. A closer relation between the professionals and the amateurs must be fostered and mutual understanding of the requirements and problems arrived at.

bearing in mind the one aim, the attainment of the highest practical efficiency and value.

The foregoing may prove distasteful and humiliating to some of those who read it; but it is just as well to call attention plainly and openly to our deficiencies. We must acknowledge the weakness of the present system as far as its capability of producing satisfactory results the emergency may suddenly demand. This being the case, it is better for us to look at the darker side for a while than it would be for us to continually hide it and go along in the cock-sure attitude of everything being all right and ready for any emergency.

THE USE OF THE 4.7-INCH GUN IN THE FIELD.

PREPARED IN THE 5TH FIELD ARTILLERY.

Editor's Note—The headings, chapters and sections used in the following notes refer to the Drill Regulations for Field Artillery (Horse and Light), 1911.

The 4.7-inch gun, adopted and issued as the standard Heavy Field Artillery field gun of the United States service has the same system of draft, uses the same class of ammunition, has the same system of mounting and method of checking recoil, and is provided with the same appliances for sighting and laying as is the standard 3-inch gun. It is, therefore, a true field artillery weapon. It differs from the 3-inch gun in increased weight of carriage and ammunition which decreases its mobility and in its rate of fire, but exceeds that gun in the range and destructiveness of its projectile. The piece can be, and therefore is, manned and maneuvered in a manner similar to that of the 3-inch gun and its operation in the field and its tactical use in conjunction with the other arms parallels that of the 3-inch matériel.

All that is prescribed for the 3-inch gun in Part 6, of the Drill Regulations for Field Artillery (Horse and Light) United States Army (Provisional), 1911, are, in the main, applicable to organizations of 4.7-inch calibre. In the following, exceptions and variations from the prescriptions of the above mentioned regulations only are noted.

PART VI (ARTILLERY IN THE FIELD).

CHAPTER I.—EMPLOYMENT OF FIELD ARTILLERY.

Section I.—Characteristics of the 4.7-Inch Gun.

Mobility.—The weight behind the team of both gun and caisson precludes movements other than at the walk save in exceptional cases and then only for a limited time. The gun will, therefore, in general operate only with infantry and its normal and prescribed place is with the infantry of the auxiliary troops of the Field Army. Batteries and battalions of this calibre gun will be detached from the Army troops for service with the Infantry divisions as the occasion may demand or as such occasion may be predicted. Service with cavalry will be exceptional as the latter would be limited

to the walk gait. The weight of the carriages is detrimental to roadways, culverts and bridges. Therefore, on a march either with or without other troops, unless otherwise provided for by the general commander, a special reconnaissance and repair detail from the Artillery itself must precede the heavy gun column and examine all bridges and culverts and strengthen them when necessary and practicable before the arrival of the carriages. Heavy roads (mud and sand) may immobilize units of this caliber unless the normal draft is increased.

Fire Action.—The shrapnel of this piece contains nearly three times the number of bullets of the 3-inch shrapnel and the bullets are of greater weight. An increase is thus secured in both density and in the area covered by its cone of dispersion while the danger space of the individual bullet is increased due to its greater weight and velocity. This will admit increasing the interval of burst. Effective shrapnel fire may be delivered up to 10,000 yards and its shell fire is destructive against material objects even beyond this range. Accuracy is limited more by difficulties of observation at the long ranges than by any limitation in the gun or its ammunition. Due to the increased weight of the ammunition the rapidity of fire is less than that of the 3-inch gun.

Ammunition Supply.—On account of the weight of the individual round a less number can be carried with the firing battery and the strictest economy must prevail in the expenditure of ammunition. For this reason adjustment should generally be platoon and the process of adjustment more deliberate than with light matériel. However, as the piece will generally operate at a greater distance from hostile artillery the resupply of firing batteries will generally be easier than in the case of the light field batteries but all officers should bear in mind that the supply in the combat trains and in the ammunition column is likewise limited and unremitting attention must be given to economy in ammunition expenditure.

Vulnerability.—The carriages provide equal if not increased protection for the cannoneers over the light field pieces due to the authorized practice of leaving the caisson limber as well as the caisson itself alongside the gun when in battery. This, however, enlarges the target presented to the enemy and it should be borne in mind that a single well placed hostile shot may disable the matériel of an entire section when unlimbered in this formation. When conditions of ammunition supply and an increase in the time for

limbering is not important, a condition frequently existing in attack and almost habitually when on the defense, it would be well to send the gun and caisson limbers to the rear with the teams or remove them beyond the destructive radius of a single shell. The increased length of time for limbering and unlimbering and the immobility of this matériel to take an increased gait for any length of time renders it move vulnerable to attack by hostile infantry and cavalry and to hostile shrapnel fire when in route formation than is the 3-inch matériel under similar circumstances.

From the foregoing consideration of its characteristics it is evident that the special and technical functions of this gun is to take up the shrapnel work of the 3-inch gun where the latter gun commences, to fail (about 4,000 yards) and to use its shell against matériel and field works beyond the power of the 3-inch shell.

The gun has other tactical functions, however, independent of these technical ones which will be considered in succeeding paragraphs.

CHAPTER II.—CONTROL OF FIRE.

(No change.)

CHAPTER III.—RECONNAISSANCE AND SELECTION OF POSITIONS.

Section I.—Choice of Position.

The closer to the hostile positions any artillery unit must advance in order to deliver effective fire against them, the more restricted is the area within which it is at liberty to select its position. Due to its long range the 4.7-inch matériel will, in general, have a greater choice in this respect than the 3-inch.

For the same reason, when seeking a covered position the problem of defilade is not so serious as at the shorter ranges. At long ranges, hedges, standing grain, or even a good background will be frequently sufficient to obscure the location of the carriages and the flash at discharge. The piece is thus capable of more general use for direct fire than is the lighter gun.

The position selected must possess a reasonable avenue of approach, not only considering the advance of the heavy matériel to position but with a view to prompt replenishment of ammunition. However, ease of observation and consequent efficiency of fire should not be sacrificed to simplify the problem of selection of a position.

The long range of the gun *does not justify its use at long ranges when its greater efficiency can be utilized at a shorter range.*

When the guns are posted at the shorter ranges (4,000 yards or less) the selection of observing stations will conform in general to the principles governing in the Light Field Artillery. As the range increased the selection of a proper station becomes of more importance and gun position will frequently have to be selected with a view to getting the best observation stations. The greater the range at which the guns are posted the greater the area over which they may be called upon to operate in the concentration and distribution of fire along the battle-line, and observing stations must be selected with a view to giving each fire unit the greatest fire mobility. Battery and battalion units may each have more than one observing station and officers charged with fire direction and conduct of fire must frequently practice rapid changes from one observation station to another and accustom themselves to adjusting the fire of their units when at distances from their batteries much greater than is the usual case when firing within 3,000 or 4,000 yards of their targets.

Section 2.—Reconnaissance.

All that is prescribed in the Drill Regulations for the Light Field Artillery regarding the preliminary reconnaissance applies with added force to units of the 4.7-inch gun matériel. Due to its relative immobility it must not be committed to inferior positions which might have been avoided by a more thorough and extended reconnaissance. This duty is most important. It requires time and any slighting is likely to prove costly in the extreme.

When there is any likelihood of this heavy matériel being needed, the senior commanders of these organizations should be ordered forward at the earliest opportunities even if the time has not yet arrived for bringing up the heavy guns in order that they may assimilate the tactical situation and inaugurate such reconnaissance as the situation may admit, at the earliest moment. When the use of the heavy matériel has not been foreseen or when an emergency suddenly arises requiring its presence it is the duty of the senior Artillery commanders on the ground to immediately inaugurate so much of a reconnaissance for the heavy matériel as the circumstances may warrant. The technical information as to targets, observing stations and gun positions will be of great value to officers

of the heavy matériel suddenly arriving on the field. Similarly it is the duty of the officers of the heavy matériel to keep themselves constantly informed as to the situation and to anticipate necessary changes of positions, changes of observation stations and any other necessary movement of their organizations by prompt reconnaissance toward the desired end.

However, when it is necessary to bring guns into action quickly for the support of other troops, the main consideration is to get them as promptly as possible to a place from which they can render effective support. In such a case, delay occasioned by the search for technics or tactical advantages is entirely inadmissible.

CHAPTER IV.—ADVANCE TO AND OCCUPATION OF THE POSITION.

(Sections 1, 2 and 3, no change.)

Section 4.—Posts and Formation of Limbers, Combat Train and Ammunition Train.

The Teams.—It will not often be necessary to post the teams in close proximity as is frequently essential with the Light Field Artillery, for the reason that unanticipated or quick movements by the heavy matériel will be exceptional, and greater latitude may be allowed battery commanders in this respect, when the tactical situation admits.

The Combat Trains.—The small amount of ammunition with the firing battery makes it advisable to hold the combat trains as close to the firing battery as is consistent with their security. No rule for actual distances can be given. It is a question of time required to get the combat train carriages with their ammunition up to the firing battery. In general they should not be over one-quarter mile distant.

Artillery Ammunition Train.—The handling of this train should be governed by the same general principles of prompt resupply, bearing in mind the limited amount of ammunition with the combat trains and firing batteries. Prompt resupply of the batteries with ammunition, men, matériel and horses is the mission of the commander of this unit.

CHAPTER V.—CHANGES OF POSITION.

These are to be avoided whenever possible even more so than in the case of light field artillery due to the relative immobility of

the matériel and this emphasizes the necessity for a thorough previous understanding of the tactical situation and a thorough preliminary reconnaissance when practicable.

CHAPTER VI.—COMBAT.

Section I.—The 4.7-Inch Gun with the Advance Guard.

The assignment of this matériel to an advance guard will be unusual if the light matériel is available and should be avoided when a reconre combat is expected. Under special circumstances, such as an advance to a prepared position, an advance behind an efficient cavalry screen, or in a pursuit, such assignments may be made and the matériel is then handled according to the principles prescribed for the Light Field Artillery.

Section 2.—The Attack.

The principal uses of the heavy field gun during the preparatory stage are:

1. To attack the hostile field artillery and cover the deployment of the light field guns and the movement to position of the infantry elements of the attack.

2. To prevent the deployment or any change of position of the hostile artillery or his infantry reserves seeking to get into position to meet the attack.

3. To attack obstacles and entrenchments beyond the power of the light field gun.

4. To prevent the formation of counter attacks and to cover the movements of the friendly light artillery and infantry to meet such attacks.

5. To assist in flanking movements, turning movements and envelopments by its long range fire.

During the decisive stage, the heavy gun batteries may be profitably employed to attack any hostile flanking batteries opening fire!

If the heavy batteries have not been moved forward during the course of the engagement, the culmination of the decisive action will generally find them at such a great range from the point of collision of the infantry lines that the safety of our own troops will require that the heavy field guns refrain from fire on the forward hostile lines. In such cases every opportunity must be embraced to attack hostile's supports and reserves; to prevent pursuit and the

formation of an offensive return in case of the failure of the attack, and to break up the formation of the hostile rear guard and cover the formation of the pursuit if the attack succeeds.

Until the result of the attack is definitely known it will generally be inadvisable for the heavy gun batteries to make any change in position. In an attack the light field guns are generally sufficiently well advanced to be secure against attack on the flank or from the rear, by the supports and reserves of the attacking line and the detail of a special support is usually unnecessary. The heavy batteries, particularly those of flank divisions, especially if placed in position at the commencement of the attack and do not change positions forward during the course of the action, may find themselves later in the engagement considerably remote from such support and endangered in case of hostile counter attacks or by hostile cavalry operating around the flanks. In such cases it is the duty of the artillery commander to make proper representation to the general commander. The actual number of heavy guns in our service will in all probability be so few in number that the loss or destruction of a single battery would be a serious blow to the service.

Section 3.—The Defense.

The defense usually implies an inferiority in field artillery on the part of the defenders and the same care must be exercised about disclosing the position of the heavy guns by premature firing as in the case of the light artillery. On the other hand there is usually more time for a skillful utilization of the available ground in order to develop fire effect to the utmost.

The principle role of the heavy gun organization in defense will be:

1. To force an early deployment of the hostile force, especially compelling him to wide turning or enveloping movements and thus gaining time for the proper disposal of the troops of the defense.
2. The attack of such of his artillery elements as interfere with the organization of the defense.
3. To support offensive returns and counter attacks made by the defense.
4. To cover by its fire the intervals between the points of support of the defense.
5. In case of the attackers repulse, to cover the formation of the pursuit, if any.

6. In case the attack is a success to cover the retirement of the friendly troops.

Section 4.—The Rear Guard.

The principal duty of a rear guard is to gain time and if assigned to such duty, commanders of the heavy gun organizations should utilize the utmost of the possibilities of the long range of their guns.

In operations which develop rapidly, and especially when there is much maneuvering, the heavy gun will rarely find useful employment; in operations in which it is sought to eliminate risks by prudent methods it will frequently play an important part.

NOTE.—It should be borne in mind both by the general commander, upon whom devolves the responsibility for the assignment of the heavy gun organizations to duties, and by the artillery commanders, upon whom falls the responsibility of recommending such assignment to duties, and the proper employment of these organizations when assigned to any duty, that in general the function of the 4.7-inch gun is to take up the work where the 3-inch gun fails for lack of range and power and performs this work to its own limit of range and power. That it is slow moving, detrimental to bridges and highways and more vulnerable to the attack of infantry and cavalry than the light field matériel; that its ammunition must be more carefully husbanded and that changes of position on its part should be reduced to a minimum.

TRAINING A BATTERY FOR FIELD SERVICE.

BY SECOND LIEUT. JOHN E. HATCH, 1ST FIELD ARTILLERY.

Lecture Delivered at the School of Fire for Field Artillery, Spring Term, 1915.

"Readiness for active service is the objective to be kept in view in all peace-time training and preparation. The value of an organization is to be judged by its all-around ability to take the field and to meet successfully every phase of war service." The foregoing extract from General Orders, No. 17, War Department, 1913, gives us in a very clear manner the foundation upon which all methods and programs of instruction should be built.

Under the existing circumstances in this country the greater part of our Field Artillery in time of war will consist of volunteers. These new batteries, with only a few months to prepare for field service will get their greatest assistance from men who had previous training in the Regular Field Artillery either as officers or enlisted men. Therefore, our methods of instruction for regular batteries in time of peace should be as far as practicable ones which could be used in the training of volunteer batteries.

In any consideration of methods of instruction it is well to consider the various objects of training:

(1) To train the officers and men in all the duties which may fall to them and to do this so thoroughly that they will be performed accurately and quickly even under the stress of active service.

(2) To increase the mental activity of the officers and men so that in all their duties they will act promptly and intelligently.

(3) To keep the men and horses fit for field service.

(4) To test under varying conditions all existing methods, to try new methods which appear to be superior to the old ones, and, in general to insure progress in the Field Artillery.

(5) To keep the men interested in their work, ambitious for personal advancement, and confident in the ability of their officers and noncommissioned officers.

(6) To give many officers and noncommissioned officers training in preparation for the increased rank which they will hold in time of war.

A carefully prepared program should be followed in all training of a battery. Of necessity this program must be very flexible to allow for many considerations as to available time, weather conditions, etc. A special point should be made to provide for suitable instruction on the stormy days when out-door work is of little or no value. (How many stormy mornings do many battery commanders' telephone almost automatically to the battery office, "Horse Exercise and First-Aid this morning"?)

GENERAL PROVISIONS.

If we could receive all our recruits for the year at one time their training would be much simplified and we could make better soldiers of them in a shorter time than under the existing conditions. This is not probable at the present time. However, if the War Department order, which provides that each regiment shall receive recruits only twice a year, were strictly carried out many of the advantages would be obtained.

The noncommissioned officers who are to act as recruit instructors should be selected at least two weeks before the arrival of the recruits and should be prepared for their work by one of the battery officers. As far as possible these men should each be given charge of the others and required to drill them as he would recruits. This will bring out those points of the different drills which are not thoroughly understood by the men and at the same time give them some experience in giving commands and explanations. It may often be necessary to take some of these instructors from the privates of the battery. These men will have good opportunity to show their worth and the battery commander will be able to judge from their work their value as future noncommissioned officers.

When the recruits arrive they should be questioned by an officer and a record made for each recruit. This record should give briefly what kind of education the man has received, what occupations he has had, what kind of work he is especially qualified to do, and any other points which may be of assistance to his battery commander or future battery commanders. To this record should be added as his training proceeds a record of his progress in the various drills.

In any form of instruction it is a great advantage to have the squad to be drilled small enough so that every man can hear every

word of explanation and see every part of a demonstration. For this reason and in order that each recruit will receive individual attention, it is best to divide them into drill squads of from fifteen to twenty men. It is certainly a mistake to drill more than thirty in one squad except in foot-drill, shelter, tent pitching and like drills.

Short drills and many of them should be the general rule. More will be gained by a live, energetic drill of three-quarters of an hour than by a dragging drill of an hour and a half. Every effort should be made to avoid monotony by giving the recruits a variety of drill even at the expense of giving them some instruction not actually of direct value to them. An example of this is giving all recruits semaphore drills. Many of them will never make use of it, but it has been welcome relief from other drills and has also developed many of the recruits mentally. Most recruits arriving at a battery are at first enthusiastic in their work and lose interest only when they see that their good work receives little notice and that they cannot advance to higher drill until the squad is ready to advance. This condition may be greatly improved by having a simple test occasionally, by posting the results of these tests, and by giving special privileges to those making the highest marks. Much can also be done by punishing indifference and laziness either by giving battery punishment or by the formation of an "awkward squad" for extra drills. When the latter method is used, care must be used not to include, and thus discourage, those men who are naturally slow to learn but are making every effort to advance.

Cannoneers' Drill (one hour daily).—This instruction should include everything which concerns the care of the matériel, the drill of the gun squad, and the service of the piece in actual fire. Each day the instructor should commence the hour by outlining the work to be taken up that day, and then actually performing all of the more difficult duties so that all the men can see how they should be done. The drill should often be broken by a short talk on subjects such as: names and functions of the various parts of the matériel, kinds and uses of the different kinds of ammunition, the rôle of field artillery in battle and the like.

All the men should be taught and be required actually to perform the work of taking apart, cleaning, oiling and replacing all those parts of the matériel which may require cleaning or adjustment.

In work with the sights, quadrant and fuze-setter, much time will be saved if the men are made proficient in setting them at the proper readings before they are given work involving both setting an instrument and laying the piece. Care must be taken in planning work with the sights that men are not kept waiting idly for their turn.

Recruits should be given this instruction for one hour a day, not including any gun drill they may have with the battery mounted.

Drivers' Drill (one and one-half to two hours a day).—As in cannoneers' drill, each day's work should be preceded by an explanation and a practical demonstration of the points to be covered. The instruction should commence with bridling and saddling, fitting the bridle, folding the blanket and mounting and dismounting. The first week or two weeks' riding should be with saddles, as this gives all the men a certain amount of confidence and prepares them for the work without saddles. As soon as they can handle one horse reasonably well they should be instructed in harnessing and part of the time given over to pair drill. All the men should be graded on their ability to ride, handle and care for his horse and these marks posted. As each man reaches the proper degree of proficiency, his name should be added to the list of men permitted to go on mounted pass. Draft drill should commence as soon as the men can handle their pairs properly, but work in equitation should continue throughout the recruit instruction. At first the amount of actual mounted work should not exceed three-quarters of an hour, but this should be gradually increased to two hours.

Stables (one hour per day).—All the men should be kept busy during stables. There is always plenty of work cleaning guns, gun sheds, or stables, and all men not actually grooming should be used in this way. A driver should never have cause to think that he is working hard caring for his team while the cannoneers are having little or no work. Recruits should be taught some good method of grooming by detail and should groom in this way until the method is so firmly fixed in their minds that they will groom properly and thoroughly without commands for changing.

General Instruction of All Kinds (two hours a day).—The time for this instruction should be divided into two or three parts, so that one of the other drills separates them. A good method is to have half of this work come in the forenoon and half in the afternoon.

At the same time that drivers' drill is increased to two hours a day, it is well to decrease this drill by half an hour. To do this, the foot drill and physical drills may be shortened. The number of different drills which can be given under this head is almost limitless, but all men should be well instructed in the following subjects: the pistol, pitching shelter tents, wall tents and pyeamidal tents; guard duty, personal hygiene and camp sanitation, and first-aid to the injured.

The following tabular statement will serve as a guide for conducting an eight-week period of recruit instruction:

| Kind of Drill. | Hours per Day. | | | | Following Weeks. |
|---|---|------------------|-------------------|--------------------|--|
| | 1st and 2d Week. | 3d and 4th Week. | 5th and 6th Week. | 7th and 8th Weeks. | |
| Drivers..... | 1½ | 1½ | 1¾ | 2 | Work continued in the section and battery. |
| Cannoneers..... | 1 | 1 | 1 | 1 | |
| Stables..... | 1 | 1 | 1 | 1 | |
| Foot Drill and Physical Drill..... | 1 | 1 | ¾ | ½ | |
| Tent Pitching, Guard Duty, First Aid, Signaling, etc..... | 1 | 1 | 1 | 1 | |
| Lectures..... | 1 hour or more per week on Saturday A. M. or Stormy days. | | | | |
| Issue of Clothing..... | When necessary. | | | | |

Foot-drill and physical drill should be considered an important part of recruit instruction and even with old men should receive some attention. While neither is essential to make a good field artilleryman, both have the effect of improving the discipline of an organization and the health of the man. Besides those mentioned above there are many other subjects in which valuable instruction may be given if time permits, such as: signaling, outpost duty, entrenching, individual cooking and entraining.

In all of the drills where it is possible, the men should be graded on their accuracy or speed, or both, and those doing the best rewarded by being excused from further drill in that subject or by some other method. For example, shelter tent pitching may be taught in this way: For the first few drills have the men pitch tents slowly, making moves properly and in the correct order. Then line up the men, explain to them that they are to be tested for speed and neatness.

Three minutes after the command. "Pitch tents," have the men cease work and stand in front of their tents. Those who have pitched their tents properly in the time should then be excused from all or a part of the drill in the future.

In all programs of instruction provision should be made for indoor work on stormy days. In almost every class of drill there is some phase upon which instruction can be given in the stable, gunshed, or barracks. These days are also the logical ones for lectures by the battery officers on such subjects as: Army regulations and customs of the service; the use of field artillery in battle, methods of fire and firing data; field artillery matériel, and the like.

At the end of eight weeks of training, the recruits should have reached the point where they can commence straight battery work.

Battery Drill.—Much space has been given in this article to recruit instruction because this is the foundation upon which all other training depends. A battery that has many men who were poorly instructed as recruits will make slow progress unless it is put through a course very similar to recruit instruction and then advanced to battery drill. In climates where there is a "closed season" most batteries could profitably spend two months of this time in following such a program. At times when all the forenoon is taken up by battery drill mounted, the afternoon drill must include all instruction not given with the battery. The men should be so divided in the afternoon that the regular cannoneers will get some riding and driving while the regular drivers are having work with the guns.

In all drills, except that of the battery mounted and of the firing battery, much of the instruction should be given to each section by its noncommissioned officers. This work must be closely supervised by the battery officers and any grave errors in the instruction corrected at the time. After the drill the noncommissioned officers are assembled and minor errors are pointed out to them by the officers in charge. Competition among sections should be encouraged and occasional tests of various kinds should be made to give the best section a chance to show its superiority. Besides these tests in actual drill, it is often of great value to have contests among the sections in harnessing, changing wheels, mounted tug of war, stake driving, and so forth.

The men of the battery headquarters detail should be given as much instruction as possible in their special duties. To accomplish

this they should attend other drills only often enough to keep them proficient. Either the substitutes should attend these drills or the regular men of the detail should often be replaced by the substitutes, otherwise the battery can never be sure of having a full detail, properly instructed. All of the men of the detail should be trained in all the duties which any man may be required to perform. Special drills of many kinds can be given with advantage, especially just before the service practice season. Some examples of these follow: drill for gunners and No. 2's only, in shifting from one target to another; drill for Nos. 3 and 4 in setting fuses of drill projectiles and then real shrapnel; drill for gunners in establishing parallel fire by reciprocal laying.

In many batteries one of the most important factors in the training of the battery is neglected; this is the school for noncommissioned officers. All of the noncommissioned officers and from six to ten selected privates should be given instruction, both theoretical and practical, in all subjects which will be of value to them in their work. This school will greatly increase the value of those taking the course and will assist the battery commander in selecting men for promotion.

The Morning Battery Drill.—Except during winter in the northern posts, this drill takes up a great part of the time available for instruction purposes. The amount of time given to it varies between two and four hours a day. This time, if properly used, should go far towards preparing a battery for field service. Unfortunately, many battery commanders make use of this time by giving instruction to only part of the men at a time. For example, when they leave the battery to reconnoiter and select a position for simulated fire, some battery commanders habitually halt their batteries at that point and leave them idle for the next ten to twenty minutes until word is received to come forward and occupy the position. This time could have been well spent in some form of drill under the senior officer with the battery. Many times an officer will put his battery in position, will compute firing data and have simulated fire for half an hour or more, and all the time the drivers will be holding their teams (or sleeping) in some nearby ravine. By deciding how long he wishes to remain in position and by giving the necessary instruction to a lieutenant or the first sergeant, the officer can have the drivers trained in harnessing, pair drill, or section drill.

In this drill it is especially necessary to avoid monotony, for otherwise the men will lose interest. If every cannoneer and driver in the battery can tell beforehand when the gait is going to be increased, how many times and where the battery is going into position, etc., they are apt to become careless and, in case an unexpected move is made, they will do their work poorly. There are many things a battery commander can do to avoid this. He can occupy a position with every indication of conducting simulated fire and then suddenly limber up at a trot and move the battery to the rear. While marching in section column, he can simulate a cavalry charge and go into action to the front, flank or rear. By sending off a few mounted men to represent the cavalry, he can make this unexpected charge very real. With the battery in position to fire at one target, he can suddenly change the fire to a new target 800 to 2,400 mils away from the first.

Marching and Camping, Equipped for the Field.—As soon as an organization is fairly well instructed in battery drill, training should commence in marching with full field equipment. These marches should at first last only one day, a camp being made in the middle of the day, a picket line stretched, horses cared for, etc. The marches should gradually be lengthened and the men given training in all things which may be required of them in active service. Some of the points which should be covered are: making and breaking camp at night, occupation of position at night, entraining and detraining, individual cooking, and camp sanitation.

This article has treated in a general way the subject of training for field service. In any given case the methods must be greatly modified to suit conditions and any prearranged program must be flexible to allow for these changes.

ERRORS IN VISUAL SIGNALS.

BY SERGT. STUARY MCLEOD, BATTERY D, 3RD FIELD ARTILLERY.

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A good deal of difficulty frequently arises amongst field artillery signalers, especially in long-distance semaphore work, when the receiver fails to "get" part of a message. Suppose the receiver misses a few letters and loses the sense of the message, he usually does not know whether he has missed one, two or more words. The authorized method is for the sending station then to send an abbreviation which means "Repeat last word, or "Repeat last two words," etc. The sender then repeats the last word or two words he sent and continues the message and it is quite possible that a vital word may be entirely missed. For example, if the following message is being sent: "Battery B will not fire on hostile batteries;" when the word "will" has been correctly read the receiver, for some reason, fails to get the remainder and "breaks in." Between the time he got "lost" and his "break in" was received by the receiver at the sending station and passed on to the sender there, it is quite likely that a fast signaler would have sent both the words "not fire," especially if the distance were sufficient to necessitate the use of field glasses. The sender at the receiving station then sends "repeat last word," and the sending station continues the message, commencing with the word "fire"; the message reads perfect sense without the word "not." and the gist of the order is entirely reversed. In Field Artillery signaling it is not usual to use checks on the number of words for inter-battalion messages, as should be done.

If, on the other hand, the receiving station, to be on the safe side, sends, "Repeat last sentence." a whole lot of time is wasted in sending a number of words which have already been correctly received. Theoretically a receiver should notice the rests, denoting "end of word." but I have found in practice that when the average signaler loses two or three letters he is literally "lost."

The following method has been used for several years and has always, without exception, worked properly.

If the receiver misses something, he says to the sender at his station, "Break in," which the sender then does. The sender then

signals some prearranged letter meaning "Repeat after" (preferably "R") and then sends back the last word correctly received, or, if it was a long word, the last four or five letters. If the last word happened to be one which would probably appear several times in the message (*e.g.*, "the," "as," etc.). he sends back the one preceding it, and the other station continues the message after those letters.

The suggestion is offered for consideration and may or may not be deemed worthy of adoption, but it has, at any rate, the merit of having proved satisfactory in three armies.

PACK ARTILLERY IN CAMPAIGN.

BY SECOND LIEUT. ALFRED G. THOMASON, 4TH FIELD ARTILLERY

A Lecture Delivered at the School of Fire for Field Artillery, Spring Term, 1915.

As almost everyone naturally supposes, the functions of pack artillery is to operate in mountainous countries. It is true that this is one of its most important functions, but it is only one of the many rôles which the pack artillery may be called upon to perform.

The English were undoubtedly the first to put pack artillery to practical use. The manufacture of a gun which could be taken apart and packed on the backs of animals grew out of the necessity for a gun which could be carried into mountainous countries, following the infantry and cavalry wherever they went and operating over terrain where it would be impossible or impracticable to use wheel artillery.

Besides operating in mountainous countries, pack artillery is especially adapted for the close support of the infantry. The gun is very mobile and can be man-handled under conditions which prevent the use of animals. For this reason pack artillery can accompany infantry over any terrain except in places in which the infantry are obliged to crawl on their hands and knees. Even in such places there are conditions under which pack artillery can follow infantry. Nearly everyone is familiar with Rudyard Kipling's verse in "Screw-Guns," in which he says:

"They sends us along where the roads are, but mostly we goes where they ain't:

We'd climb up the side of a sign-board an' trust to the stick o' the paint."

In order to support infantry closely, a pack battery must be self-reliant and as far as possible independent of any assistance beyond that of the escort usually assigned to it. To my mind, this is an argument in favor of assigning machine guns to pack artillery. In order to make their pack batteries as far as possible independent of assistance, the French are the cannoneers with rifles. This, however, is not the only way in which a battery can be self-reliant. The most important thing for a battery is to be able to put its guns where they are needed by means of their own transportation and at the

proper time, and not have to depend upon another arm at the critical moment. If, for instance, when time presses and the infantry has to help the artillery drag its guns into position, one of its principle rôles is defeated.

An article from the German on the Russo-Japanese War, translated by Lieut. Donald Armstrong, Coast Artillery Corps, illustrates this very well. "The Russian field piece proved much too heavy for the mountain warfare. When once in position it was withdrawn in the face of fire with great difficulty. In one case, with the assistance of the infantry, two batteries were hauled over a pass only after two hours and a half. Thus the artillery could not follow the infantry, but had to be helped forward by them. As a result, the whole of the artillery was not brought along, and at length that which had come was sent back for fear that in a possible retreat it could not follow and would fall into the hands of the enemy."

The emplacing of the guns in this mountainous terrain was as difficult as the march. For instance. Von Tetlau states: "The pieces were transported half-way up the mountain side by ten horses, then dragged up the rest of the way by the infantry, with ropes. The slope was so steep in places that one gun at its first shot rolled all the way down the mountain." Undoubtedly guns so placed fell into the hands of the enemy very easily. As a matter of fact, a battery so placed at the pass of Pagon became a prize of the Japanese. It was due in part to the enormous weight that the Russians lost so many guns to the enemy.

It will thus be seen that the Russian field gun was in no way suited for the campaign in Manchuria, as far as mobility was concerned. If Russia could not or would not obtain a lighter piece, one would naturally think that a larger number of mountain batteries would have been provided. But such was not the case. At the end of April, 1904, only one old mountain battery was to be found in the entire army. Only at the beginning of the campaign were eighteen batteries (108 quick-firing mountain guns) provided. This lack of pack artillery made itself doubly evident, owing to the heavy field guns, the mountainous terrain and also to the lack of machine guns.

On the other hand, the Japanese Army was well supplied with pack artillery, having 162 pieces, the advantage of which was felt, not only in mountainous regions but in time of bad weather also.

From this we see that while it is not impossible to use light artillery

in rugged and broken country, it is very difficult and requires time. In a march from Vera Cruz to Mexico City, for instance, light artillery would have been very much handicapped, on account of the rugged country, undergrowth and lack of roads. I doubt very much if it could have kept up with the infantry, while on the other hand, pack artillery would have been in its element. A translation from the *Revue d'Artillerie* for February, 1913, illustrates the use of pack artillery in the Balkan War.

"The Servians used mountain artillery exclusively as accompanying batteries. The Servians, as well as the Turks, had considerable mountain artillery. Its employment in broken countries was self-evident. At Prelip it was all that could go into action on account of the difficult formation of the terrain. At Monistair the facility of pack transportation as well as the curvature of its trajectory, allowed the mountain matériel to accompany the infantry and to take positions behind cover with steep slopes."

In summing up the foregoing, we can see that the pack artillery has two principal functions. First, that of operating over mountainous terrain which is impracticable for light artillery; second, to accompany any advancing infantry more closely than is possible for light artillery. In emergency and when under fire, the guns can be hauled by hand considerable distances by means of the drag ropes, the animals remaining under cover in rear.

These, however, are not the only functions of pack artillery; there are several others which are quite important, such as the occupation of concealed positions less practicable for wheel artillery, by means of its quietness and mobility. In rough, hilly broken or heavily wooded country, such as a jungle, to permit more rapid occupation and change of position than can be made by wheel artillery, especially if the roads are poor or if there are no roads at all. As an infantry battery because of its relatively high angle of fire and its resultant effect on troops in trenches. In a siege it can be hauled by hand through the works to the most favorable position in the least time.

To accompany a landing force, its guns can be landed in small boats without any special arrangements and can thereafter be hauled by hand with ease, as compared to other guns. As an example of this may be cited the landing of the Marines at Vera Cruz with their 3-inch guns. They found it almost impossible to use their guns except on the paved streets and finally had to have some

harness made and buy some Mexican mules before they could make any progress at all.

Pack artillery should not be opposed to light artillery, it should not be expected to hold its own against artillery of superior power. Its ballistic inferiority is a great handicap and a suitable mask will seldom be available in actual service. Consequently, a battery of pack artillery should not be assigned as a counter battery against an enemy armed with guns of superior power and who are experts in their use.

FRENCH MILITARY EXPRESSIONS DIFFICULT TO TRANSLATE EXACTLY INTO ENGLISH.

BY GEORGE NESTLER TRICOCHÉ, LATE LIEUTENANT, FRENCH FOOT ARTILLERY.

Adjudant is not "adjutant," unless followed by the word *Major*. Used alone, it refers to a noncommissioned officer, who may be either a sergeant major (or acting sergeant major) or, in a battery, a chief of platoon.

Adjudant-Chef—The highest noncommissioned officer in the army. His duties are the same as the *adjudant's*.

Artificier is not "mechanic." Name given, until recently, in the artillery, to one man by section who was instructed in the use of explosives, etc. He wore a special stripe and ranked between the corporal and the private. There was also in every battery a sergeant known as *Sous Chef Artificier*, and, per regiment, a first sergeant called *Chef Artificier*. There are no such men or noncommissioned officers in the present organization.

Bataillon is never used, in French, when speaking of mounted troops. In the artillery, the correct expression is *Groupe* (m). The latter is commanded by a *Chef d'Escadron*, which is not a very logical name.

Brigadier is corporal of mounted units or foot artillery. The same expression is sometimes used when speaking of a brigadier general (*Général de Brigade*).

Infirmier does not mean a disabled soldier. It is a member of the sanitary squad of a given unit, or a private of the hospital corps. There is one *infirmier* per battery, who is an artilleryman, like the litter-bearers (*brancardiers*), of whom there are four per battery.

Maréchal des Logis—Notwithstanding his name, he has nothing to do with the "lodging" or quartering of troops. It is the sergeant of artillery and mounted units. As late as the eighteenth century, this name was given to a sort of quartermaster. There was, at the court of the French Kings, a *Grand Maréchal des Logis*, who was superintendent of the palaces, and, in the field, the quartermaster of the royal household.

Maréchal des Logis Chef is the first sergeant of artillery or mounted units. See *Sergeant Major*.

Maréchal-ferrant is a farrier. Often this name is shortened into *Maréchal*. Therefore, the latter word, used alone, has two meanings: first, field marshal; second, battery or troop farrier.

Musicien is not a battery bugler. This name is given only to members of a military band.

Officier d'ordonnance is not an officer of the corps of ordnance, for there is no such corps in the French Army. He is an officer of the general staff acting as aide-de-camp.

Ordonnance is, properly speaking, the officer's "striker." This substantive, strangely enough, is of the feminine gender. A mounted officer entitled to more than two saddle horses has a second orderly, and so forth. Orderlies are supplied to general and staff officers by the *Train des Equipages Militaires*—a branch of the artillery arm. See *Planton*.

Planton—An orderly whose duty is only to carry messages, etc. but who never performs the duties of a "striker." The *planton* is not officially recognized in the battery or the battalion. But there are five *plantons*, in time of war, attached to the staff of the brigadier general commanding the artillery of an army corps.

Section in the battery, means a platoon. The English "section" is called *pièce* (f.).

Sergent is never used when speaking of mounted units (or foot artillery). See *Maréchal des Logis*.

Sergent-Major is not "sergeant major." It is the first sergeant of unmounted units (except foot batteries).

Sous-officier is a noncommissioned officer. The highest in rank is the *Adjudant Chef*; the lowest is the *Sergent* or the *Maréchal des Logis*, according to the arm. The corporal is not a noncommissioned officer in France.

RUSSIAN FIELD ARTILLERY DRILL REGULATIONS, 1912.

BY CAPT, EDWARD T. DONNELLY, 3RD FIELD ARTILLERY.

Based upon a Translation from the "Revue Militaire des Armées Etrangères," by First Lieut. West C. Jacobs, Coast Artillery Corps.

There has come to us through the *Revue Militaire des Armées Etrangères* a review of the Russian regulations of 1912 for the operations of field artillery in combat. These regulations having been deduced from the experiences gained in the Manchurian war and being at the present moment under test in the tremendous conflict in Europe, are of the utmost interest to all students of military training.

The "Introduction" lays down the fundamental principle that the rôle of artillery is essentially that of supporting the other arms. It then goes on to discuss the characteristic properties of field artillery and to describe the different uses to which batteries of artillery proper, howitzers, mortars, horse artillery and heavy siege guns should be put.

Under "General Remarks," the regulations discuss the duties to be performed by the various commanders. In the operation of large forces, the supreme commander appears to retain a greater degree of direct control over his artillery than is the case under our regulations. To illustrate this point, we may quote from the text on the subject: "The artillery commander should receive from the detachment commander (not receiving he should request) orders and information concerning the initial mission of the artillery, the sector to occupy, the time available in which to open fire, opening fire, new missions and new sectors to be occupied as a result of the development of the combat, the probable points and directions of the attacks and the movement of the final attack." Of course, the strictness with which the above passage will be construed and the extent to which it will be applied will depend—as it always does—on the personality of the commander concerned, but it is unfortunate that a provision at least hampering to one's initiative should be so definitely announced in a set of training instructions. Even to the artilleryman of good judgment and decision this provision must in many cases be an obstacle to prompt action, while to the timid commander it furnishes a shield behind which he can either remain inactive or fail to meet changes in the situation calling for immediate

action. Our own regulations are more happily framed in this particular and incorporate the principle that, having assigned a certain mission to the artillery commander, he should be allowed to accomplish it in the way that appears to him most suitable always, of course, providing that it is in harmony with the general plan.

To those who have studied the Russo-Japanese War and noticed the marked lack of preparation shown by the Russian artillery in the earlier combats, the present regulations dealing with the reconnaissance will be of great interest. In examining the subject we are first struck with the large personnel assigned to this duty. In each battery there are nine mounted and three dismounted scouts. Prior to the reconnaissance, each battery places at the disposal of the group commander one officer and all its scouts. This furnishes for purpose of reconnaissance three officers (in addition to the group adjutant) and twenty-seven men. It must be borne in mind that the Russian battery has eight guns and that the group—corresponding to our battalion—has twenty-four guns. It is difficult, however, to see the necessity for so large a personnel, even with the greater number of guns in the group, unless the Russian reconnaissance is much more thorough than is ours. The regulations recommend that whenever practicable one or more officers be sent forward the day before a movement is to be made to plan itineraries. The column is always preceded by a patrol of noncommissioned officers, who assure its freedom of movement. While it is interesting to study these elaborate preparations for the march into action, it is thought that the advantages to be derived—especially from itinerary reconnaissances—are not sufficient to justify the labor involved. The choice of routes will be dependent on the movements of the troops—usually there will be no choice—and it would seem to be quite sufficient for the group commander in going forward in reconnaissance to utilize markers, as is prescribed in our regulations. The provisions as to the reconnaissance of the position are admirable. The reconnaissance officer organizes from one to three advanced reconnaissances, each of from six to eight scouts. With them he reconnoiters up to the most advanced infantry lines. The duties of these patrols are to occupy all positions available for observation, to study the terrain, both friendly and hostile, and to locate positions for their own batteries and, if possible, those of the hostile artillery. From the foregoing we see that a large part of the duty of reconnaissance is delegated by the Russian group commander to his reconnaissance officer.

In the service of communication we see the same elaborate preparations that the Russians prescribe in their regulations for the reconnaissance. Each battery has eight signalmen, two of whom are mounted, and four telegraph instruments. Apparently no provision is made for the use of telephones. Much reliance is placed on lateral observers, whose functions appear to be tactical as well as to observe the effect of fire, and the means of communicating with these is provided for in the regulations.

In discussing the subject of artillery positions, the regulations classify them as open, semi-defiladed or defiladed. This is an advance towards simplification which we might do well to follow. The necessity of introducing a number of definitions showing degrees of defilade is not apparent. If the situation demands cover, then the best cover available will be taken, and to describe dismounted defilade, sight defilade and the like is simply to complicate messages. As might be expected, the Russians show preference for defiladed positions, but definitely state that when circumstances require that fire be opened immediately, the choice of positions is in no way to be retarded by secondary considerations. Artillery commanders are not to forget that there are occasions when artillery should act audaciously and sacrifice itself in open positions.

The Russians refer to the difficulty of going into position under cover. They suggest movements at night as a solution of this problem and state that, time permitting, a long and roundabout approach under cover is advisable. In the matter of changes of positions, they state, "The difficulty of artillery in changing position under fire on open ground will frequently compel it to make these changes during the night."

The Russians favor firing by group, and they lay stress on the importance of concentrated direction of fire. In this connection they state that "The concentration of fire of several groups will be obtained more from the concurrent solutions of problems of fire in accordance with a general idea that from a simultaneous fire on a common objective." This is nothing more than the application of the principle of unity of direction. They lay down no fixed rule on the subject of firing over their own infantry and evidently regard it as normal procedure, relying on their artillery scouts with the infantry to furnish information as to when the artillery fire is becoming dangerous to their own infantry.

The commander of the firing units has no responsibility concerning the replenishment of ammunition. It is the duty of the

battery reserve commander to keep up an uninterrupted supply to the firing battery and a similar responsibility rests on the commander of each echelon in rear, with respect to the one next in front. The regulations recognize the necessity of great expenditures, and, while they provide for an abundant and uninterrupted supply, rigid economy in expenditure is enjoined.

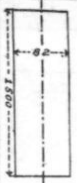
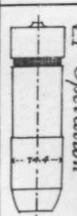

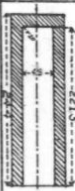
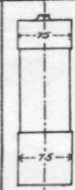
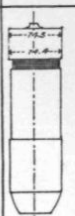

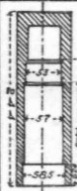

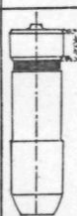
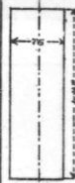
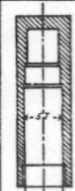


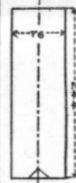
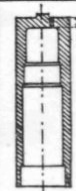










The Russians attach much importance to the use of artillery in connection with reconnaissance of a hostile position. They recommend that fractions of artillery scattered over wide areas occupy defiladed positions and by rapidity of fire and changes of position deceive the enemy as to their strength and dispositions. In these regulations may be traced a desire to avoid fire at extreme ranges and a preference for an advance to the closest possible positions.

Referring again to their adherence to the principle of unity of direction, the following quotation from the regulations is instructive: "All the artillery designated to support the attack, with the exception of a small fraction designated to cooperate closely with the infantry, is under the order of a single commander, responsible for the success of the operations; in general, this commander will be the artillery commander of the fraction designated to make the decisive blow."

The Russians do not favor a preliminary preparation by artillery. They prefer that the opening of artillery fire and the advance of the infantry be simultaneous, and their regulations state that "artillery fire without a simultaneous attack by infantry cannot be productive of fertile results to the latter, and the efforts of the artillery should be in close harmony with the action of the infantry."

Perhaps the most important feature of the Russian regulations is the emphasis put upon the subject of reconnaissance and the duties of the personnel assigned to this work. When we recall the action of the Russian artillery in Manchuria—particularly in the earlier combats—when it came recklessly out in the open or occupied defensive positions along the crests and skylines—and then examine the elaborate provisions of the present regulations for the preparation for action and occupation of the position, we should be more than ever impressed with the importance of this work and the necessity of developing the highest order of training for the personnel assigned to it. It may be that the bitter experiences of the Russians have carried them from one extreme to the other, but the lesson of the regulations is none the less impressive.

Operations for Manufacture of Trutch 75% Shell

| | | | |
|---|---|--|---|
| <p>1st Operation Cutting the bar in pieces of 1500</p>  | | | <p>20th Operation Screw in head</p>  |
| <p>2nd Operation Turn the bar to 76 7/8"</p>  | <p>8th Operation Finish rebaring with a drill shaped reamer having shape of bottom of hole</p>  | <p>14th Operation Turn in 75 the part of the base and the part near head before being re-chilled</p>  | <p>22nd Operation True cone on side nearest base</p>  |
| <p>3rd Operation Cut the bar Six inches of 244 7/8"</p>  | <p>9th Operation Male borings of 53, 57 and 81.5</p>  | <p>15th Operation Rectify part near head to 74.7</p>  | <p>23rd Operation Make bowl on each side of base</p>  |
| <p>4th Operation Mill Out false centers</p>  | <p>10th Operation Leather the piece on mandrel with diameter of 5 1/2</p>  | <p>16th Operation Cut shell to proper length and bore for threading</p>  | <p>24th Operation Turn projectile to get proper ogival curve</p>  |
| <p>5th Operation Leather at one End the Pieces of 244 7/8"</p>  | <p>11th Operation Cut bottom of base to a thickness of 1 1/2</p>  | <p>17th Operation Thread</p>  | <p>25th Operation Shrink on Rotating Band</p>  |
| <p>6th Operation Feed with an old drill greater hub of 4.4 in finish with a new drill of one very large of same diameter</p>  | <p>12th Operation Temper</p>  | <p>18th Operation Make the emplacement for rotating band</p>  | <p>26th Operation Cut Rotating Band to proper diameter 2nd file edges</p>  |
| <p>7th Operation With a long slightly pointed drill begin giving bottom of hole its final aspect</p>  | <p>13th Operation Turn accurately center of body of shell to 7.4</p>  | <p>19th Operation Harden band emplacement</p>  | <p>27th Operation Cut off tailer</p>  |

CURRENT FIELD ARTILLERY NOTES

The 105-Millimeter Field Gun.

The French 105-millimeter guns, of which such excellent reports are heard, are organized into four gun batteries and three battery battalions. There is no regimental organization except for administration, and the battalion commanders report directly to army commanders.

The characteristics of the 105-millimeter gun are reported to be as follows:

| | |
|---|--------|
| Caliber, inches | 4.13 |
| Muzzle velocity, foot-seconds | 1,870 |
| Weight of projectile, pounds | 36.3 |
| Maximum range, approximate, yards | 15,000 |
| Limits of traverse, mils | 100 |
| Weight of piece limbered, pounds | 5,720 |
| Weight in battery, pounds | 5,060 |
| Number of rounds in caisson | 42 |

The length of recoil is about 1 meter; and the recoil and counterrecoil system are constructed on the same principle as that adapted with such success for the 75-millimeter gun. The gun is equipped with excellent shields, and a panoramic sight. For use on soft ground, a mat platform, about 2 by 3 feet, strongly reinforced, is placed just in rear of the gun wheels, which recoil on the mat.

Each section is provided with two caissons, which are unlimbered and placed one on each side of the piece. A battalion is assigned an ammunition train of twenty-three auto trucks, carrying between 3,500 and 3,800 rounds of ammunition.

Telephone Communication for Interior of Brigades.

There has been devised and issued from the office of the chief signal officer for preliminary test to two of the brigades now on duty on the southern border an equipment consisting of a small switchboard, a new form of buzzer, which gives a particularly loud call and excellent telephone service, and a light type of field wire, together with a special reel which holds about three-fourths of a mile of this wire, for use in such brigade lines of information.

The buzzer is of the same dimensions as that with which the service is already familiar, but has some change in the circuits and



FIELD SWITCH BOARD IN USE.

has a key that is adapted more for giving buzzer calls than it is for extended telegraphing. The small switchboard, which is shown in the accompanying illustrations provides for service with five lines, which, in general, will take care of the three regimental lines; two others to outposts or other uses.

A special board has already considered the general system, which was given a preliminary test at Douglas, Ariz, and has reported very strongly in its favor. There seems to be a great demand springing up



THE FIELD SWITCH BOARD

in the service for buzzer or telephone communication extending even further down into the units within the regiment—that is, it seems to be desired to have communication established with battalions and companies as well.

The apparatus described above would undoubtedly be fitted for such use as this if it was desired. Material such as this has been requested a number of times from the signal office and estimates have been put in therefor, but from considerations of economy the items have been stricken out of the estimates.

An outfit of this apparatus for brigade communication will be sent to the Field Artillery camp at Tobyhanna, Pa., this summer,

together with various other electrical apparatus for communication, including field radio sets, buzzers, etc. A special type of visual signal cart will be sent by the chief signal officer for test, which includes everything requisite, for visual signaling within a division.

Signal Equipment for Tobyhanna Camp.

The Chief Signal Officer of the Army has made arrangements to have the Signal Corps cooperate with the Field Artillery in a very practical way during the joint Field Artillery camp at Tobyhanna this summer.

A full equipment of signal apparatus suitable for field artillery use will be sent to the camp, together with sufficient Signal Corps personnel to insure its proper use and test. The equipment will include small radio sets, a radio set on a Jefferey "Quad" motor tractor, improved buzzers, a large number of special rockets, and means for signaling with Very pistols, using smoke cartridges which are reported as being visible for several miles.

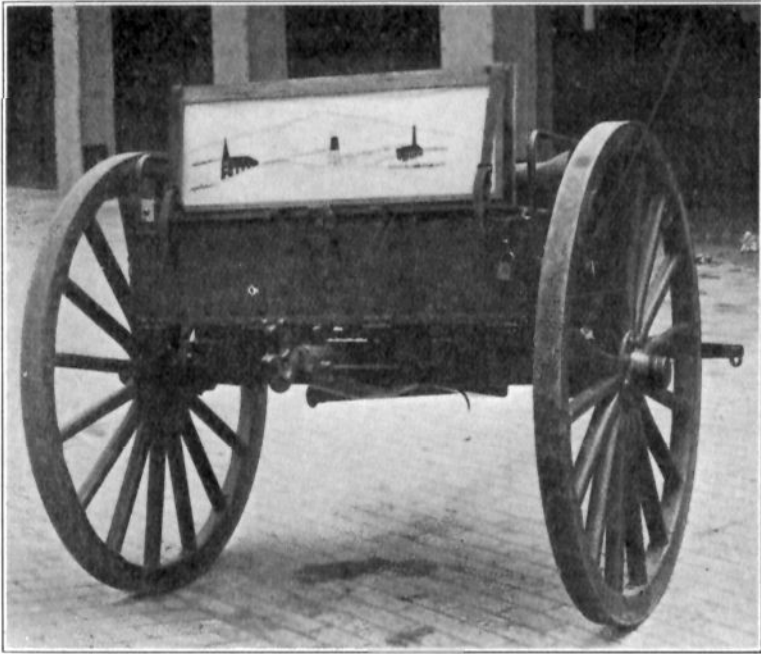
Flashless Powder.

Tests of flashless powder for the 3-inch field gun having been favorably reported upon, additional tests with this powder for use with the 4.7-inch gun, 4.7-inch howitzer 6-inch howitzer are soon to be conducted by the Field Artillery Board at Fort Sill.

Lighting System for Militia Batteries.

Referring to the system for lighting the sights, quadrants and fuse-setters of Militia batteries for use in armories at night, which was described on page 587 of the October-December, 1911, issue of the FIELD ARTILLERY JOURNAL, a description of a slightly different system in use by Battery C. Field Artillery. Organized Militia of Georgia, has recently been received. The current for this system is furnished by dry batteries placed in the emergency ammunition tubes on the piece and in the ammunition tubes of the caisson body, instead of being taken from the armory lighting system, as in the method previously described. This would appear to be an improvement, as it admits moving the carriages without disturbing the lighting. A 4-candlepower light is secured to a 4-foot piece of light insulated wire, and an ordinary metal book clip is fastened to the base of the

light by means of tape. This clip is then snapped to the brake handle for lighting the quadrant, to the sight leaf for lighting the sight and to the bracket of the fuse-setter. The system was devised by Sergt. J. C. McDowell, Battery C, Field Artillery. Organized Militia of Georgia.



TRANSPARENCY AIMING POINTS FOR MILITIA BATTERIES.

The problem of obtaining a suitable aiming point for night drill in militia batteries has been solved very cleverly in Battery C, Field Artillery, Savannah, Georgia. The transparency is lighted by a small electric light. It is used on a limber, and can be moved to any convenient place.

Artillery Officer's Diary.

The following diary of an English artillery officer is reprinted from the *London Globe*:

We had a few contretemps yesterday—really the diary of a battery in action when things are going all wrong would be very amusing—something like this:

3 a. m.—Darkness and snores prevail in the officers' billet. Enter the sergeant major—addresses the room. "Brigade order—guns to be in action by 6.30, sir!"

Muffled voice: "Shurrer door, rain's going down my neck."

Having delivered his message in spite of his chilly reception, the sergeant major withdraws, taking the weather with him.

5.45 a. m.—General upheaval—the junior subaltern kicks the major in the ribs getting out of bed—the atmosphere becomes sultry for at least five minutes—the servants are found to be fast asleep, and the orderly officer falls heavily down three steps in his efforts to wake them.

5.55 a. m.—The captain can't find his boots—on striking match he finds that the senior subaltern has thrown them onto his pillow (the captain's), which is thereby rendered muddy—lively interlude ensues between captain and sergeant, who is put temporarily out of action.

6.10 a. m.—A lamp having been found and lit, comparative calm prevails until everyone becomes simultaneously impatient at the nonarrival of tea.

6.15 a. m.—All simultaneously, "Where the blankety blank is that tea?" A disheveled cook appears in the door and reports that owing to part of the roof having fallen in during the night (it has previously been seriously displaced by shells), the breakfast is buried, and they can't light a fire, as the rain has wetted the wood.

6.20 a. m.—Breakfast is hastily made of the only surviving piece of bread and some unearthed cheese, helped down by rum and water.

6.25 a. m.—Four depressed officers wade down to the guns, through the mud and the darkness, while the major and sergeant major, and one telephone man, proceed to the observing station.

6.35 a. m.—No. 3 gun detachment complain that their carefully constructed shelter pit has fallen in during the night and is now flooded.

Having dug out the unfortunate gunner who made this exciting discovery, they proceed with vehement blessings to dig a new pit.

7.15 a. m.—It being now light, and a German having been sighted in the distance, the major orders "one round battery fire." This is accomplished, but the sudden awakening of the silence has so affected the guns that No. 1 has convulsions, and Nos. 4 and 5 sink so far into the mud that they cannot be laid, and No. 6 shelter pit falls in.

While these little contretemps are being dealt with, a German battery appears in the distance, and the major, desiring to cause them inconvenience, sends a whole string of orders down the telephone, in the middle of which the telephone "down tools" and refuses to transmit the voice of the telephone man, should he ever so loudly.

An interesting conversation ensues between the telephonist at the battery end and him at the observing station: "Orl right—I 'eard yew—can't yew 'ear me? Lorst me voice, 'ave I? Jest yer wait, me boy! I'll show yer oo's lost 'is voice!" Followed by a dissertation on the value of soap applied to the ears, and sundry remarks

on the unwisdom of putting one's feet through the receiver—not one word of which can be heard at the other end.

7.45 a. m.—Telephone reconsiders its decision and unanimously decides to resume work. In the meantime, however, the opportunity has passed, and the major, whose temper has not been improved by a fall into a flooded shell crater in the dark on his way to the observing station, passes a few well-chosen remarks concerning idiots who can't talk into a telephone.

A period of comparative peace ensues.

9.30 a. m.—The major, having suddenly discovered that the Germans are still on the earth, decides to wake them up again. Gives out a new target to the battery and opens fire.

Meantime, however, Nos. 1 and 2 guns, tired of the monotony of shooting at Germans, have taken unto themselves a new and original line, and fire brazonly into our own trenches.

The subsequent altercation is cut short by a German shell, which neatly cuts the telephone wire. An expedition departs, not without misgivings, to mend the wire.

No sooner is everything mended, however, than it is promptly cut by another shell in a different place.

1.30 p. m.—In the midst of an important series of orders, coming over the telephone, affecting the safety of the British Army and the issue of the battle, a mounted orderly dashes up and delivers a message from some anxious ordnance officer asking whether the battery is up to establishment in bootlaces, and stating that if any braces buttons are required, they must be drawn at once from railhead on pain of death.

The orderly is politely requested to proceed to several unpleasant places at once and report on arrival to the evil spirit in charge.

2.30 p. m.—During a furious cannonade, a message comes from the infantry to say they don't know if we are aware of it or not, but all our shells are bursting in the middle of a large plowed field, where there are not nor ever have been, any Germans.

And so the day goes on until finally we crawl to bed, feeling that we are all miserable worms, and that the British artillery would be far better at home.

The following day a grand manifesto is published thanking everyone for the splendid way in which they have upheld the best traditions of the army—and thanking the artillery in particular for the excellent manner in which they supported the infantry under very trying circumstances. The "trying circumstances" are admitted!

Aeroplane Control of Field Artillery Fire.

Arrangements have been completed for sending an aero company of the 1st Aero Squadron to Fort Sill, Okla., on or about August 13 for the purpose of conducting a series of experiments in connection

with the Field Artillery Board and the School of Fire for Field Artillery with a view of determining the best methods of aeroplane reconnaissance for field artillery and of aeroplane control of fire.

The aero company will consist of three captains, one in command and two as aviators, six first lieutenants, thirty-eight enlisted men, four aeroplanes, four aeroplane carriers (motor trucks), one motor cycle, and two motor trucks for transportation of supplies.

The ammunition for the test will consist of approximately 700 rounds provided by reducing the annual allowance of the five Field Artillery regiments in the United States proportionately. In addition there will be the ammunition provided for the annual practice of the 5th Field Artillery which will be held at Fort Sill during the time that the aeroplanes are there.

GERMAN ARTILLERY NOTES.

For these translations from the "Artilleristische Monatshefte" we are indebted to First Lieut. Edmund L. Gruber, 5th Field Artillery.

Long Range Guns.

According to a dispatch to the *Frankfurter Zeitung*, the correspondent of the *Times* in Paris has learnt from persons in the diplomatic circle, that the latest surprise of the Germans is a new naval gun that they have built which will shoot 3 miles (5000 m.) farther than the best English and which has, according to German reports, even a still greater effect than the 42-centimeter mortars.

"Taschenbuche der Kriegsflotten für 1914" states that the most powerful English naval gun is the 38.1-centimeter (15-inch), caliber .45, which fires a projectile weighing 885 kilograms, with an initial velocity of 760 meters. Krupp's also constructed in 1914 a gun 40.64 centimeters (16-inch), caliber 50, which fires a projectile weighing 920 kilograms, with an initial velocity of 940 meters. The muzzle energy of this gun is 58 per cent. greater than that of the English gun. It is very possible that the extreme range of this gun exceeds that of the English gun by 5 kilometers (about 3 miles).

From all available reports the longest range actually fired was attained at Meppen in the presence of the Kaiser on April 28, 1892, with a 24-centimeter (9.45-inch) gun, caliber .40, this range being 20,266 meters. The initial velocity probably did not exceed 800 meters.

The Krupp 40.64-centimeter gun, caliber 50, which is difficult to install on battle ships, with an elevation of 30°, will probably fire at a range of about 42 kilometers (about 46,000 yards—26 miles). Since the Straits of Dover at the narrowest part are 33 kilometers wide (about 36,000 yards—20 miles) a zone of English territory extending inward 9 kilometers could be covered with fire (or 5½ miles from the coast).

The Cockerill Works Under German Management.

The capture of Liege has delivered into German hands the great steel works of John Cockerill at Seraing. The works employed about 11,000 laborers and in addition to machinery of every description also

made a specialty of artillery matériel. The Belgian field guns modeled after the Krupp gun were built here. The works manufacture also projectiles, siege guns of medium caliber and armored turrets. The daily output of projectiles was 400; this number can, however, be doubled without much difficulty.

Immediately after the capture of the fortress, the management of the works was assumed by a German colonel of artillery. The former general manager of the powder and arms factory had declined to carry out the order of the German commanding general to manufacture projectiles. He and the chief engineer were thereupon forbidden to leave their quarters. The wages of the workmen were guaranteed and were increased 50 per cent. on account of the high cost of the necessities of life. All persons who give any trouble whatever or who destroy or damage any machinery, and so forth, subject themselves to trial by a military court.

Fort Loncin fell on August 15, and on August 17 Cockerill's was reopened and again in working order.

Reinforced Concrete and Projectiles.

The pictures of the destruction of the Belgian forts produced by the 42-centimeter mortars, the fortifications of which were constructed in great part of concrete and reinforced concrete, produce at first glance a very singular impression. The concrete walls and covers show no clean perforations by projectiles but are completely destroyed, and especially at such places where the explosive effect of a projectile is plainly out of question. This behavior of reinforced concrete when subjected to the impact of projectiles was ascertained in firing experiments, as described in an article by Prof. P. Rohland, concerning the behavior of reinforced concrete. The projectiles upon striking did not produce perforations or cracks as is the case with steel plates, but smashed the concrete walls into many small pieces. The reason for this peculiar behavior of concrete Prof. Rohland believes is to be found in the colloidal chemical state of the concrete whose molecules are exceptionally closely pressed together causing a state of great stress and tension. If this tension is disturbed at any place by an impacting projectile, the result will be the complete destruction of the layer of concrete. If this view is correct, then both concrete and reinforced concrete are absolutely useless for fortifications. At least concrete walls, arches, cover, etc.,

should not be used in such places where they would be exposed to the impact of projectiles. Rohland recommends that in the construction of fortifications we return to the use of brick. If a brick construction is struck by a projectile, the result will be only a large hole, because in consequence of the lesser connection only the bricks in the vicinity of the point of impact will be included in the destruction.

December, 1914.

CONCERNING THE USE OF GERMAN ARTILLERY.

In the *Army and Navy Journal* of October 31, there appeared an article by an English general staff officer concerning the use of the German artillery, as follows:

The accuracy of their guns may on first thought be disturbing especially in view of the fact that the guns are usually masked because the covered position from which they shoot is generally very difficult to locate. But as accurate as their fire has been, it must be said that the Germans have had very little luck, and during the past three weeks an astonishingly small proportion of the projectiles which they have fired has produced any effect at all. The most remarkable thing is the rapidity with which they succeed in concentrating their fire on any particular point. Very often they forego establishing a bracket, especially when they are on the defensive, and then direct their fire by using telephones and maps divided into squares. For example, if a target is found or appears, its position on the map is telephoned to the battery which it is intended to use against all targets appearing in this square.

Certain guns are assigned to observe particular roads, firing upon the enemy as soon as he appears. Both in the reconnaissance of targets and in the observation of fire, great dependence is placed upon the observations and reports made from aircraft and balloons; they also make use of special observers and secret agents, who are sent forward in advance or are left behind upon retreat in the hostile line and report their observations by telephone. Such observers have been found in hay stacks, barns and sheds and other buildings, far distant from the German lines.

In spite of the perfection of their preparations and means of observation the Germans are guilty of a great waste of ammunition. On the other hand they are very careful in finding cover and concealment for their troops and their guns. They usually construct for themselves temporary or double positions so that if the fire becomes too warm for them in one position they are able without loss of much time to change to and occupy the other.

This report taken from a professional journal is typical of most reports on the war. They are based more upon the imagination and phantasy of the writer than upon reliable observation. It cannot be denied that this report of the English staff officer displays a touch of expert opinion. Thus, for instance, he has at some time heard of the firing of our Foot Artillery by use of charts, such as was formerly customary in the attack of fortified places and as is

still practised in the French Foot Artillery. This method of directing fire by using a map or chart divided into squares was discarded a number of years ago by the German Foot Artillery. I do not know the sources of the writer's knowledge concerning the use of our air craft.

The report would be deserving of just as much credulity if one substituted the word "French" for "German" wherever the word appears. In general, one must be very skeptical of such reports. It is always best to keep in mind the admonition of the psychologist, who recommends even in time of peace to accept the testimony of eye-witnesses with the greatest circumspection. A caution which is so pertinent in time of peace is, indeed, still more so in time of war.

Artillery and Infantry Fire Effect.

Whereas after the Manchurian War, it was maintained on many sides (although based upon rather unreliable information), that artillery fire and especially shrapnel fire, was a grand fiasco, the present war has shown us some big surprises and among them the decided superiority in effect of artillery fire over infantry fire. This is a fact that has never before been observed in other wars. From the experiences of the wounded who have been invalided home, we know that the fire of the French field artillery, especially their shrapnel fire, was much more effective than that of their infantry. Again, the losses in wounded produced by the German field artillery are also far superior than those produced by our Infantry, as is shown in a report which the French Surgeon Dr. Hartmann has just made to the Academy. He treated 311 cases of seriously wounded. Of these 189, or 60 per cent., were due to artillery fire and 99, or 31.8 per cent., were due to infantry fire, while in 23 cases or 7.4 per cent, the cause could not be determined. Accordingly, the ratio of casualties due to artillery fire to those due to infantry fire is as 1.91 to 1. According to the most favorable reports, this ratio in the Manchurian War was as 0.22 is to 1—some sources even giving a ratio of 0.05 to 1. In considering the dead, the ratio is probably still greater in favor of the artillery.

High Bursts.

Many officers returning from the theater of operations are said to have observed that the French usually burst their shrapnel too

high to produce much effect. This, of course, is a very difficult matter to judge by an officer who is not at the hostile firing point, for he seldom knows at what range the projectile was fired. Since the French, according to their firing regulations, use, as we do, a 3-mil height of burst, the actual height of burst increases with the range. If a hostile battery is firing at a range of 5,000 meters, the mean point of burst should be 15 meters high; it may, however very easily be even 3 meters higher without being able to trace an error either to the battery commander or the firing battery. This is due to the fact that in establishing the corrector during adjustment one may actually have, instead of a 5-meter (1-mil) height of burst, an 8-meter height of burst. With the point of burst 8 meters high, there will probably be a great number of observable bursts due to the great vertical dispersion in the bursts. A point of burst 18 meters high will appear unusually high to every officer who has not during firing practice at long ranges observed the results and effect from a point near the targets, and this is especially so if he is to one side of the line of fire and does not see the target at which the fire is being directed. Individual points of burst may, due to the influence of dispersion, be as high as 40 meters. This will thus emphasize the impression that the bursts are too high especially when, as is usually the case, the low bursts are not observed.

In firing against targets behind a mask—as a hill, an embankment or woods, etc.—there may be a false height of burst, in which case the effect will be greatly reduced. For example, let us assume that a hostile battery is under cover behind a hill, the reverse slope of which has an angle of slope of 5° . If the battery is in position 150 meters from the crest, it will be 13 meters lower than the crest. A battery firing at this target would adjust on the crest with time fire and then, according to the Firing Regulations, would raise the bursts in passing to fire for effect. At a range of 5,000 meters the points of burst would then be about 17 meters above the line of the crest, but would be actually 30 meters high with respect to the hostile battery itself. If now in searching the area behind the crest, we proceed as prescribed in the Firing Regulations, that is by dropping back 100 meters from the short limit of the bracket and then fire successive volleys with increments of 50 meters in range, the first three volleys (points of burst -250/30, -200/30, and -150/30) will be ineffective, because most of the bullets of the upper nappe

pass on over beyond the target while those of the lower nappe strike on the front slope of the mask. The next volley (-100/30) will in spite of or rather on account of the great height of burst produce some effect. The succeeding volleys will produce only a very slight effect because the majority of the bullets pass on over beyond the target and because the width of the zone of dispersion at the target is so small that any small error or deviation in deflection will be sufficient to nullify all effect. For this reason our Firing Regulations prescribe, "If there is reason to believe that the target is some distance below the crest or the mask, the bursts should be lowered occasionally to avoid overshooting." The difficulty is that there is seldom any positive information as to the position of the target. Against masked targets of this nature it is in my opinion much better to fire successive volleys beginning at the short limit of the bracket (in other words not to drop back 100 meters) using the same height of burst as obtained during adjustment. At least this is advisable with the light gun; for the light howitzer low points of burst are not so good. For the howitzer the bursts can only seldom be too high.

What has here been said for the range of 5,000 meters, applies in an even higher degree to shorter ranges. Under the same conditions, and the range been 2,500 meters, the bursts would have been only 21 meters higher than the target. But on account of the smaller angle of fall the results would have been even more unfavorable.

A hostile (French) light gun battery, if in such a position that the crest can be cleared only with an elevation of 5° (90 mils), could fire only at such targets as are over 3,100 meters distant. In order to fire at targets at a shorter range, it would be necessary to get farther behind the crest. Under such circumstances the bursts of a battery firing at such a target would also be higher, the effect, therefore, less.

At the present time, firing from masked positions presents fewer difficulties than firing against masked positions (targets). Although aero observers no doubt can render very valuable services in such cases, it is impossible for them to help us out of all the difficulties. Especially will it be impossible for them to give information whether the bursts are too high or too low.

Once More Concerning Gen. Percin.

After Gen. Percin has been thrice reported dead (as reported in the November, December, 1914, numbers) each report giving a

different account concerning his death, it is now stated as a positive fact—if such a word may be used in discussing events of the war—that he is very much alive and is now defending himself against his enemies. The latest report states that he was given command of an army in northern France at the outbreak of the war. In a battle—probably the twenty-third of August—he had hastily and without reason given the order to retreat and to evacuate the fortress of Lille. The excuses which he made for his action were so amazing that it was believed that he had lost his head and he was relieved from command.

He has during the last few weeks taken up his defense against these accusations and now declares that the order to evacuate Lille was given by M. Messimy, Minister for War, who had acceded to the pressure and entreaties of the wealthy manufacturers and merchants of Lille not to make the city a theater of operations. It is stated that Rheims was also evacuated for the same reasons; indeed, the same came very near happening to Paris on the second of September, but Gen. Gallieni, who had just been appointed governor of Paris, vehemently opposed the demands of the city council to declare Paris an open and unfortified place, but proceeded with the greatest energy to fortify the city, something which had up to that time been entirely neglected. These facts are given as the real reasons for M. Messimy's elimination as Minister for War and the appointment of M. Millerand.

Between Percin and the Commanding General-in-Chief Joffre, who belong to different political parties, there has been in the past much friction. The difficulties have been of such a nature that in the fall of 1913 Gen. Joffre caused Gen. Percin's retirement. The latter was at that time a member of the *conseil superieure de la guerre*. Through the activities of his political friends Gen. Percin was again placed upon the active list.

Gen. Percin had incurred the displeasure of the clerical and royalist parties, both strongly represented in the army, while he was cabinet chief under the Minister for War Andre (1900-1904), who, as is well known, interrogated the prefects concerning the political affiliations and religious convictions of the officers of the army. An idea of how bitter the feeling was against Gen. Percin can best be gained by describing again a meeting which he one day had with Gen. Hagron, at that time commanding general-in-chief. They met

each other on a pleasure ride in the Bois de Boulogne. Percin, at that time a colonel, saluted and greeted his chief in the prescribed manner, which salute the latter purposely and demonstratively ignored. Col. Percin turned his horse about, repeated the greeting but Gen. Hagron again cut him dead. Thereupon Percin rode along side the general and said: "General, I have given myself the honor to greet you," whereupon the latter answered, "Colonel, you need not greet me; I desire that our relations be strictly official." As a result of a complaint made by Col. Percin, Gen. Hagron was placed in arrest in his quarters for two weeks as reported by newspapers.

Under such circumstances it is, of course, difficult to be convinced otherwise than that politics had a great deal to do with Percin's relief. Gen. Percin is no Chauvinist, is a strong opponent of the unnatural alliance with Russia. He has expressed himself as opposed to the three years' service with the colors and a strong increase in the artillery because he values a good army higher than he does one that is numerous but composed of a large number of mediocre elements.

A Lieutenant of Field Artillery Earns the Iron Cross, 1st Class.

This beautiful distinction has been earned by Lieut. von Holst, of the Grand Ducal Field Artillery Regiment (1. Baden), No. 14, who was not commissioned as an officer until after the outbreak of the war. The decoration was given for service in the conduct of fire purely technical in character, opportunity to show which will in only exceptional cases fall to a platoon commander. Since small operations of this nature give us many practical hints in warfare I will give a complete account of the event by quoting an extract from a letter which Lieut. v. Holst has written to me in answer to my request.

"On the _____ of _____ our infantry succeeded in taking the village V _____ and then occupied it with a battalion; our battery (light guns) was detached to support this force. At this part of the line the enemy was far superior to us in artillery so that we were compelled to take the defensive. The orders were to hold the village under all circumstances; but there was to be no firing except in case of a close and imminent attack or of a night attack. The position was like a wedge driven forward into the hostile line, causing us to be under constant artillery and infantry fire from the flanks. Nevertheless all hostile attacks were repulsed with ease.

"On the road leading to M ————— about 80 meters from the point which we occupied, there was a group of houses, from which the enemy was able to sweep one of our infantry trenches with an enfilading fire and thus to produce considerable losses among the occupants. The infantry battalion commander called upon the battery for support, and the task was assigned to me. As has already been mentioned we were permitted to fire at night or under cover of darkness only. An attempt to solve the problem from a position about 500 meters distant from the group of houses in question was unsuccessful; it was too dark and there was also danger of hitting our own infantry in the trench about 80 meters this side of the target. I therefore looked for and also found a more suitable position near the road exit from the village and to the left of the trench. It was the only possible position, for from any other place farther to the rear the target was completely masked by the buildings of the village. The position selected was large enough for one gun only, and could not hold a caisson in addition. Our great difficulty was to get the gun and ammunition into the firing position without the enemy observing or finding out this fact, the road bed being completely covered with broken tile and stones from the demolished houses. I first had ammunition baskets—forty shrapnel and twenty shell—carried singly to the firing position; part of the time the men crawled on all fours. The gun then followed, being moved by hand, mats and mattresses being spread in front of the wheels in order to avoid all noise. We succeeded in getting everything into position unobserved but were eight minutes late—orders being to fire the first shot at 4 a. m. I made no haste in anything but made all my preparations calmly. Before opening fire we had also to remove some of the road paving in order to give a lodgment for the trail spade; a few branches which obstructed the field of fire had also to be removed. With a delay of eight minutes the first shot, percussion shrapnel, hit the target—the left house of the group. The next shots, whose direction I gave as each one was fired, followed in rapid succession. Our infantry opened fire at the same time we did. The enemy also then directed a furious fire from the front and from the right at our gun, which at that moment was plainly illuminated by the moon that just then came from behind a cloud. Little sparks flashed all over the piece every time a hostile bullet struck some part of the metal. In a very short time two men fell killed and three were wounded. In the meantime four of the buildings

in the group had been bombarded and we were just about to fire upon the fifth one, when I was wounded in the thigh by a musketry bullet. The effect of the blow and the resulting muscular contraction caused me to collapse, but I was otherwise sound and fresh, and was able to give direction to the chief of section in continuing the fire. Since I had only the chief of section and three men left with the gun and since it was also necessary that I acquaint myself with the state of our ammunition supply, I gave the command to cease firing and let the men take cover. In the meantime the musketry fire of both sides also died down and very soon only individual shots were falling. Soon after this I was carried to the rear and given first-aid. On the following day I learnt through my battery commander what success had been attained. The flanking fire had ceased almost altogether. Our gun was not damaged, only the shield, which was perforated in many places."

The conduct of this young officer and his men is "above praise." Out of ten men six were put out of action, but at no time is discipline or composure lost. The assurance with which this officer made all his preparation is very remarkable. This he was able to do only because he had had the advantage of a superior training and had mastered all his technical duties. Before being commissioned as an officer he had had almost two full years' service, of which one and one-half years were in a battery as a cannoneer and noncommissioned officer. He had at first entered the service as a one-year volunteer and did not make up his mind to try for a commission until after his first year. His thorough preliminary training stood him in good stead at the Military Academy (*Kriegs-schule*) so that he was able to follow the instruction with ease and understanding and to pass his officer's examination with imperial commendation. This convinces me again as I have so frequently contended that it would be best not to send ensigns to the Military Academy (*Kriegs-schule*) until after they have done one full year's service with troops.

January, 1915.

Once More Concerning High Bursts.

The article on "High Bursts" appearing in the January number of this monthly was based on a normal height of burst of 3 mils. This applies only to the German light field gun and light field howitzer and to the French 75-millimeter gun, but does not apply to the French howitzers or other short cannon. The latter made their appearance on the field of battle shortly after the outbreak of the

war. According to the *Reglement de manoeuvre de l'artillerie a pied*, of 1910, the proper height of burst for shrapnel of howitzers using full charge is 8 mils, which is almost three times as great as with us. But the French artillery also recognizes and uses shrapnel zone fire, not only for medium angles of elevation—under 45°—but also for high angles of elevation—over 45°. For medium angles of elevation the average height of burst is 12 mils, for high angles of elevation it is 20 mils, or almost seven times as great as we use. Even though it is improbable that shrapnel zone fire has been used in field operations or battles, we should keep the above mentioned facts in mind and not consider it unusual if the guns of fortified places should happen to use such high bursts. The howitzer shrapnel usually have a base bursting charge and a very small angle of opening; it is, therefore, necessary to use a much greater height of burst, otherwise the shrapnel bullets will not spread sufficiently.

It is best always to keep in mind a fact which experience has taught us, namely, that at the firing point the mistake is usually made of estimating the height of burst smaller than it actually is. This error in estimation will naturally cause the bursts to be too high.

French Heavy Artillery.

At the beginning of the war the French heavy artillery was decidedly inferior in strength to the German; according to the Italian journal, *Corriere della Sera*, the relation in strength was as 24 to 80. A few years ago the French had only twenty-one batteries of 155-millimeter howitzers. Shortly before the present war six regiments of heavy artillery were organized. In the course of the war, it was said that the heavy artillery has been greatly increased so that now, according to newspaper reports, it is equal to the German in strength. Even before the outbreak of the war it was contemplated to introduce the 10.5-centimeter howitzers and the long 12-centimeter gun, the experimental firing with these guns having been very satisfactory. Anyway, the government and private ordnance manufactories have received large orders to manufacture both guns and ammunition of this type. But it can be also positively stated, that it has been impossible to make up all these deficiencies in so short a time. It is most probable that a large number of heavy guns have been removed from forts that are not threatened and have been placed in field fortifications and positions. These guns are in part of obsolete construction.

In main part the deficiency has been met by confiscating all guns and ammunition which had been ordered at private manufactories and some cases also paid for by various foreign nations, especially by Italy, Russia, Roumania and probably also some other Balkan nations. In an emergency of this kind it was, of course, necessary to take into the bargain the disadvantages of a very motley armament.

In one way this fact shows how important it is for a nation not to be under tribute or obligations to another in the matter of armament; on the other hand it also shows now necessary in time of war are the activities of private industries. Government manufactories alone would not be able to meet the enormous demand resulting from the great expenditure of ammunition and the deterioration and use of arms.

The French Light Gun Shrapnel.

The French 75-millimeter gun, M/97, was first supplied with shrapnel having a base bursting charge (*obus à balles à charge arrière*) for which another type of shrapnel "*obus Robin*," similar to the German shrapnel M/91, was substituted. As a matter of fact, both types are still being used, as is shown by the unexploded cases which have been picked up. The first mentioned type has a case with very thick walls, the inside of the case plainly showing the groove in which the diaphragm is lodged. This type (base charge) contains only 261 shrapnel bullets and has a bursting charge of only 110 grams; whereas the "*obus Robin*" contains 290 shrapnel bullets and has a bursting charge weighing 440 grams intermingled with the shrapnel bullets. The weights of the two shrapnel are almost the same, the first being 7.25 kilograms and the second 7.24 kilograms. In outward appearance they are easily identified in that the base-charged shrapnel is painted red, while the "*obus Robin*" is painted white.

Great Ammunition Deficiency in the French Artillery.

According to information received from reliable sources, France is now experiencing a serious deficiency in ammunition for its heavy artillery, because it went into the war with false assumptions concerning the use of this particular arm. At the outbreak of the war, France is said to have had on hand 2,000 rounds per gun. The consumption turned out to be very much greater. In order to meet this deficiency, forty-two large lathes were recently purchased in

America for the purpose of manufacturing heavy artillery ammunition. (From the *Rundschau*, Vienna.)

Gen. Percin Restored to the Active List.

The belief which we have stated in this journal, that Gen. Percin was a victim of his political opponents, has been confirmed. He has received from the war minister, M. Millerand, probably as a consequence of a complaint lodged with the latter, a letter in which the war minister reiterates a verbal statement made some time ago, to the effect that Gen. Percin was in no way responsible for the evacuation of Lille in August, 1914. The war minister has taken the general's wishes under advisement with the provision of restoring him to the active list of the army.

Italian Armament.

According to the *Zuricher Zeitung* the Italians have completed the armament of their field artillery, the greater part of which was still armed with guns with the single trail and trail spade. Ten out of twelve army corps are already armed with the Deport gun, of which only four guns were on hand early in 1914. It is said that every army corps has received twenty-four batteries of four guns each, which would give a total of 960 guns. The 75-millimeter Krupp guns, M/06, which are still suited in every way to meet the requirements of modern war and which fire the same ammunition as the Deport guns, are to be transferred to the reserve corps.

At the Armstrong Shops at Pozzuoli near Naples, seige guns of the heaviest caliber are said to be under construction and are said to be just as good as the Austrian 30.5-centimeter mortars.

It is said that motor trucks are on hand for the heavy artillery, and that these trucks are able to haul the heaviest siege guns along the steepest Alpine roads.

And, finally, it is said that at the arsenal at Terni a machine gun is being manufactured which is renowned for its lightness.

German Artillery Losses.

PUBLISHED NOVEMBER 30, 1914.

A—FIELD ARTILLERY.

| | Officers | Men |
|-----------------------|----------|-------|
| Killed and died | 276* | 4438 |
| Wounded | 1053 | 15213 |
| Missing | 23 | 1146 |
| Captured | 6 | 10 |
| | <hr/> | <hr/> |
| Total | 1418 | 20807 |

*6 died from sickness; and 2 killed while on duty with aero troops.

CURRENT FIELD ARTILLERY NOTES

429

B—FOOT ARTILLERY.

| | Officers | Men |
|-----------------------|----------|------|
| Killed and died | 32* | 427 |
| Wounded | 78 | 1716 |
| Missing | 2 | 119 |
| Captured | 1 | 6 |
| Total | 123 | 2268 |

*3 died from sickness.

LOSSES PUBLISHED DECEMBER 31, 1914.

A—FIELD ARTILLERY.

| | Officers | Men |
|-----------------------|----------|-------|
| Killed and died | 362* | 5358 |
| Wounded | 1250 | 18826 |
| Missing | 29 | 1337 |
| Captured | 5 | 10 |
| Total | 1647 | 25531 |

*10 died from sickness; and 3 killed while on duty with aero troops.

B—FOOT ARTILLERY.

| | Officers | Men |
|-----------------------|----------|------|
| Killed and died | 51* | 696 |
| Wounded | 113 | 2450 |
| Missing | 2 | 160 |
| Captured | 2 | 8 |
| Total | 164 | 3314 |

*5 died from sickness.

LOSSES PUBLISHED JANUARY 31, 1915.

TOTAL LOSSES.

A—FIELD ARTILLERY.

| | Officers | Men |
|----------------|----------|-------|
| Dead | 446* | 6110 |
| Wounded | 1362 | 21206 |
| Missing | 31 | 1418 |
| Captured | 7 | 32 |
| Total | 1846 | 28766 |

*13 died of sickness, and 3 killed while on duty with aero troops.

B—FOOT ARTILLERY.

| | Officers | Men |
|----------------|----------|------|
| Dead | 77* | 831 |
| Wounded | 134 | 3036 |
| Missing | 2 | 244 |
| Captured | 2 | 9 |
| Total | 215 | 4120 |

*8 died of sickness.

(The above lists were consolidated from the *Artilleristische Monatshefte* for December, 1914, and January and February, 1915.)

NOTES REPRINTED FROM SCHOOL OF FIRE NOTES.

THE SERVICE BUZZER.

NOTE.—Experiences in the European War indicate that the telephone may often not be relied upon because of noise or of injured wires or the necessity for using bare wire uninsulated, such as fence wire, or for other reasons. Similarly it is indicated that visual signalling will often be impracticable. So it is believed at the School that the buzzer must be widely utilized and that thorough proficiency in its use must be attained in all units of Field Artillery. For these reasons and also in the hope that a more thorough knowledge of the instrument itself may result in keeping it available in good repair and in saving expense the following is circulated. The original was obtained from the Signal School at Fort Leavenworth. A few changes have been made here and here also the large diagrams have been attached.

1. Given an induction coil consisting of a primary winding of a few turns and a secondary winding of many turns on a soft iron core, some devise rapidly to make and break or vary the primary circuit and a source of electromotive force, then an alternating current of high voltage can be obtained from the secondary coil. The ordinary telephone receiver is marvelously sensitive to alternating currents of frequencies of the order of 500 to 1,000 per second. By combining these two principles the present service buzzer has been evolved.

2. The buzzer requires no adjustment at the receiving end except as noted in Paragraph 10. Leaks, bad connections and high resistances, any one of which would cause loss of some or all of the signals on Morse instruments, simply affect the loudness of the signals in the receiving telephone. The delicacy of the telephone receiver makes telegraphy possible over lines long after Morse operation has ceased.

3. From the general principles involved, it will be seen that a telephone transmitter may be substituted for the key and interrupter to vary the current in the primary and the resultant current in the secondary. The buzzer then constitutes a telephone station. This feature is of great importance, especially in the operation of tactical lines.

4. This buzzer is $7\frac{1}{2}$ inches in length, $5\frac{1}{4}$ inches wide and $3\frac{3}{4}$ inches deep, all outside measurements. It weighs 5 pounds. The

case is of aluminum, covered with fair leather and provided with carrying strap. Two Type A Tungsten dry batteries (three volts each) provide the primary current. These batteries are inserted through a hinged door in the end of the case and they fit against spring contacts at the other end of the case and contacts on the door. The electrical connections are automatically made through these contacts. A hard rubber case is mounted over the batteries and on it are mounted the induction coil with interrupter, two sets of condensers, the sending



THE SERVICE BUZZER, MODEL 1914.

key, the "Rec." key and the line jack together with binding posts to which are attached the cords of the telephone transmitter and the receiver. The two latter with their cords and the line plug with its cord and connectors are packed for transportation in the space between the base and the back of the case. A wrench and screwdriver handle and two screwdriver blades fit into sockets in the case. Instructions for use are permanently mounted on the inside of the cover, together with a diagram of circuits. That diagram is so simplified that it bears little resemblance at first glance to the real circuits of the instrument.

5. The plates show, in the center, the actual wiring in grooves on the under side of the base and the various parts are shown above and below this diagram and connected at the proper points with the corresponding points on the base by dotted lines.

The primary circuit for telegraphy is as follows: Battery: 1+, a, lug P, primary of coil, lug PS, b,c, back under contact of key, front under contact of key, d,e, point of interrupter, vibrator of interrupter, f,g, battery 2—. The two batteries are in series. The primary condenser shunts the break of the interrupter.

The primary circuit for telephony is as follows: Battery 1+, a, lug P, primary coil, lug PS, b,c, binding post RT, transmitter, binding post T, battery 1—. Battery 1 alone is used in telephoning. The button switch on the transmitter must be pressed while talking.

The secondary circuit for telegraphy, sending is as follows: Line jack ring, h, i, lug S, secondary of coil, lug PS, line condenser switch, k,l, line jack tip. The line condenser may be interposed in the circuit by opening the switch, that is, pushing it in the direction indicated by the arrow. This is only done when it is desired to use the buzzer on a line already being utilized for Morse sending, *i. e.*, a line carrying direct current; the condenser preventing flow of same through itself, yet allowing the alternating current of buzzer and telephone to pass freely. The normal position of the switch is pulled toward the interrupter screw, that is, short circuiting the line condenser. No noise is heard in the receiver on sending because the first effect of closing the sending key is to open the upper contact which is in the receiver circuit.

The secondary circuit in telephoning, both sending and receiving, and in telegraphing, receiving, is as follows: "Line jack ring, h,i, lug S, secondary of coil, lug PS,b,c, binding post RT, receiver, binding post R,m, upper contact of key, base of key, n,o, line condenser switch, k,l, line jack tip. The key "Rec." in models 1912 and 1913 when pressed, short circuits the secondary of the coil and removes its resistance from the circuit. It is used in receiving only and then only in case of very weak signals.

In the 1914 model this "Rec." key is replaced by a single pole double throw switch whose poles are marked "B" and "T." By consulting the diagrams of this model the action of the switch is apparent, *i. e.*, on buzzer side the secondary is out of circuit when sending key is in normal position, thus removing its impedance from

line when receiving, and placing the receiver only, in series with line. It is also seen that the phone element cannot be used under these conditions. When sending key is depressed the receiver is removed from the line by virtue of upper contact of key opening, thus removing its impedance and rendering it silent when sending. With switch on "talk" side the telephone element is normal; the buzzer may also be employed, but with less efficiency than before because the receiver and secondary are both in series with line when sending key is normal, *i. e.*, when receiving.

TO USE THE BUZZER AS A TELEPHONE.

7. The key is closed and opened several times to draw the attention of the operators at other stations. The operator at the calling station calls the letter or call letters of the station wanted, signing at intervals his own call; when answered, he informs the station called to use the telephone, which is done by sending the word "fone."

To use the telephone, press in the bottom on the transmitter while talking and hold the transmitter vertically or substantially in the position in which the transmitter on a commercial telephone is mounted. If held horizontally the granulated carbon in the receptacle of the transmitter may not touch the front carbon disc and the transmitter will not operate. In the 1914 model, switch should be first placed on "T" or "talk" side.

CARE OF BUZZERS.

8. A buzzer used at a station such as at a tent in the camp, will cause but little trouble. Occasional battery renewal, whether the instrument is in use or not, is necessary. The battery must be renewed when, after all key, interrupter and other contacts have been cleaned and tightened, the interrupter works feebly on its best possible adjustment.

The buzzer, however, carried by operators gets out of order at times, due to being jarred while carried on horseback, especially when traveling at the faster gaits. This can frequently be obviated by seeing that all connections are tight and that the buzzer does not rattle when shaken after being packed and closed. The line plug with its cord and connectors must always be packed with the receiver and transmitter and never carried separately.

The operator who takes proper care of his buzzer will seldom have to turn it in for repair.

ADJUSTMENTS AND LOCATION OF FAULTS.

9. Sometimes, even with all precautions, the buzzer will not work. When such is the case, the first thing to do is to try and locate the trouble. The trouble may be in the buzzer, in the connector, or in the line.

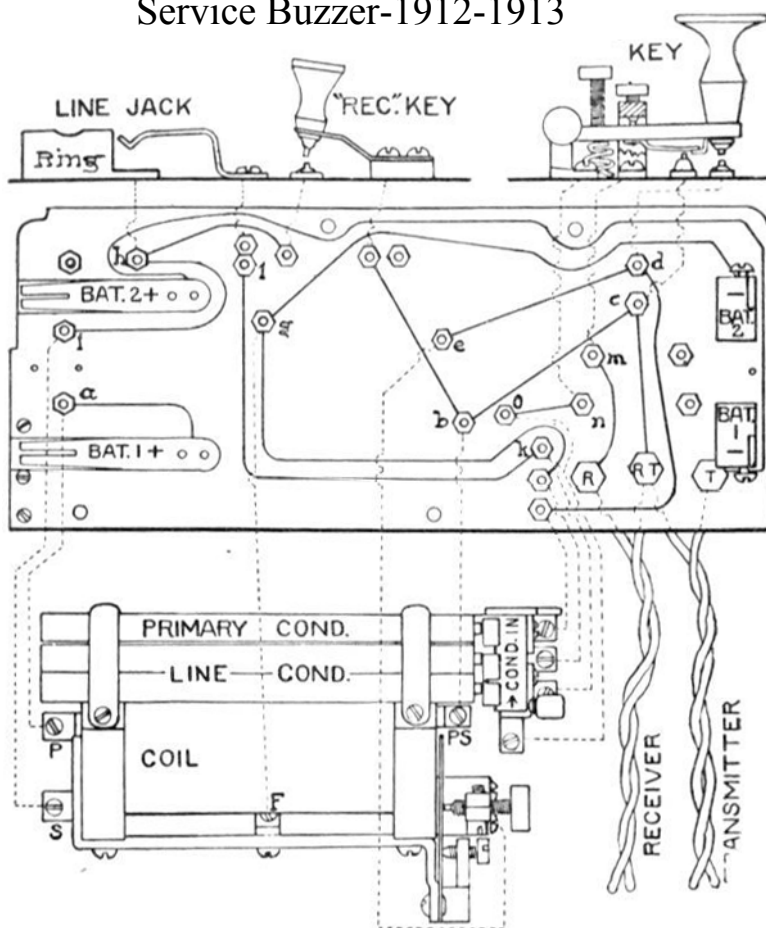
10. An operator, on being issued a buzzer, almost invariably feels called upon to adjust the play of the sending key and the tension of its spring to his individual liking. It is a vital point in the operation of this buzzer that the two lower contacts of the key remain open when the key is open and that both close when the key is pressed. It is desirable that the back lower contact closes first when the key is pressed and also that the spring be strong enough to insure proper pressure on the upper contact when the key is open. Smoothness of operation of the key can often be secured by proper adjustment of the two pivot screws, leaving the spring pressure fairly strong. Reference to the plate will show that the upper contact of the key is in the receiver circuit and therefore a bad contact here will cut down the strength of the signals. If the back lower contact does not open when the key is open, the receiver will be short-circuited and no signals will be received. If the back lower contact does not close when the key is pressed, the primary circuit will not be completed and the interrupter will not buzz. Each operator should have a buzzer permanently issued to him and after he has adjusted the play of the key and the spring tension, the proper adjustment of the back under contact should be made by an expert and the operator warned not to change his key adjustment. The adjustment of the back under contact is made by bending up or down the L-shaped strip on which the flat spring rests when the key is up.

11. The two batteries should be inserted into the battery compartment bottom first so that the zinc bottoms rest against the spring contacts under the sending key. The contacts on the door when it is closed will press against the brass terminals of the carbons. These carbon terminals and zinc bottoms should be cleaned and brightened before insertion of the batteries. The buzzer will not operate if one battery is reversed in the compartment.

On rare occasions after hard use the zinc containing case of a battery

will be eaten through and the electrolyte will escape and corrode all brass work in the compartment. If this occurs, the base on which the instruments are mounted should be removed by taking out the four screws in the white circles (two under the condensers) and the

Service Buzzer-1912-1913



metal work of the compartment and the wiring on the bottom of the base should be cleaned thoroughly, and dried before the base is replaced.

12. With the key in proper adjustment and a good battery in the instrument, there is little difficulty in adjusting the interrupter. The

contacts between the screw point and the vibrator spring should be clean. The vibrator spring is first adjusted so that it lies parallel to the end of the coil and very near but not touching the iron core. Loosen the locking screw of the screw point and unscrew the point well away from the vibrator spring before making this adjustment. A slip of paper should pass freely between the vibrator spring and the iron core of the coil. Now carefully screw in the screw point until it just touches the vibrator spring and the buzzer should operate. Adjust for loudest operation and test for operation as the sending key is rapidly opened and closed while tightening up the locking screw. If the key, battery and vibrator spring are all in proper condition and the interrupter either fails to operate or operates with brilliant sparking at the contact, the primary condenser is either short-circuited or open. Remove it and replace with one of the line condensers which are identical with it.

13. The receiver and its cord can be tested by touching two poles of a dry cell to its binding posts, or by disconnecting the cord on (R) post and touching it on post marked (T). A sharp click should be heard. The receiver rarely gets out of adjustment and should not be opened except by an expert. The whole secondary receiving circuit can similarly be tested by touching the two connectors on the line plug cord to the two poles of a cell when a sharp click should be heard in the receiver.

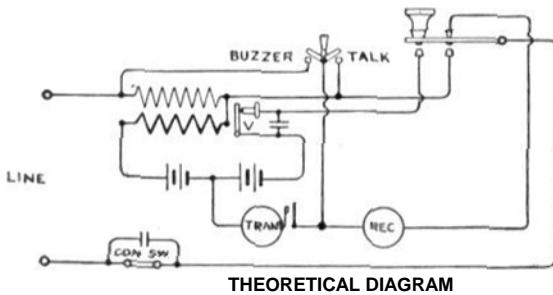
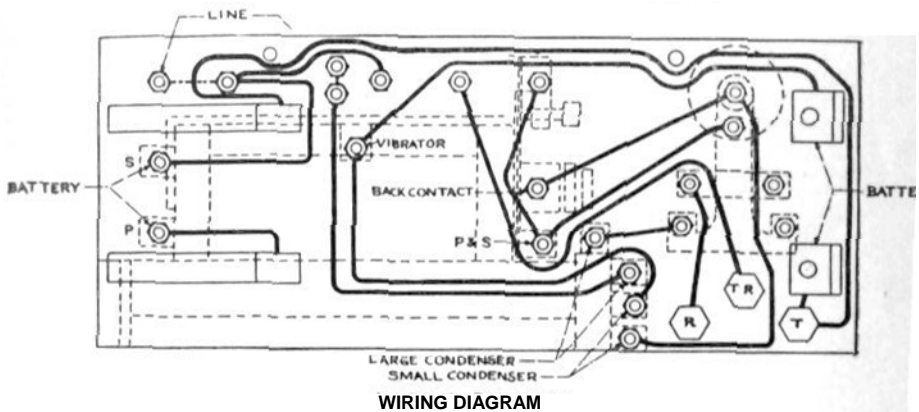
The transmitter and its cord are only in circuit when the buzzer is used for telephoning. A complete test of the talking circuit can be made by listening in the receiver with line short-circuited and blowing in the transmitter while pressing the button switch and letting it go. The blowing should be distinctly heard when the switch is closed. The rear cover over the switch and connections can be removed in the event of a fault being localized there. The transmitter proper must never be opened under any circumstances as this will invariably result in its complete destruction.

EMERGENCY OPERATION.

14. The service buzzer may be the only telegraph and telephone instrument that will survive and operate properly in active operations in the field. Therefore, a few suggestions on its operation when spare parts and supplies can not be obtained and some possible uses in the theater of operation follow.

15. When no Tungsten Type A batteries are available take four dry cells of any type and connect them in series with leading-in wires from the two end cells and from the connection between the two middle cells. The used up batteries being removed from the case, attach one end wire to lug P of the coil and the other end wire

SERVICE BUZZER — MODEL OF 1914.
DIAGRAM OF CIRCUITS



to the horizontal bar along the side of the coil. The middle wire goes to binding post T and is unnecessary if the telephone transmitter is not to be used.

This system of wiring in battery may be used to advantage where the buzzer is permanently installed in an office but fine wire must be used to get it under the screw heads.

16. If the line plug is lost or broken, the two parts of the line jack may be scraped bright and the line and ground wires wrapped

around them several turns and twisted up tight. Watch the insulation of the wires at this point.

The "Rec." key models 1912 and 1913 is not a vital part of the buzzer and, if damaged, need not be replaced. Keep the contacts of this key well separated.

Any telephone receiver and cord may be substituted for the receiver and its cord.

Any local battery transmitter may be substituted for the telephone transmitter, but a common battery transmitter will not work satisfactorily. A switch must be provided in the transmitter circuit if an ordinary transmitter is used.

The line and primary condensers are identical and may be interchanged. The line condensers are only essential in the rare case when it is desired to bridge buzzers on a line already being used for Morse signaling. The primary condenser reduces sparking at the interrupter terminals and is not absolutely essential although it should be in circuit if a condenser is available.

It would be difficult in the field to find substitutes for the sending key and coil, but they are of rugged construction and not liable to damage.

17. In addition to the ordinary use of the buzzer on field company lines, some of these uses are possible:

It may be used as an office instrument on long, badly insulated lines where Morse operation is impossible or unsatisfactory. It will work through a break and dead ground if both ends of the wire at the break are grounded.

It may be connected to a local battery telephone switchboard for use as a telephone, in which case the point screw of the interrupter must be carefully screwed up against the vibrator spring until the latter just cannot move when the key is pressed. The call and ring-off are made by a few dots with the key. This method will operate line and cleaning-out drops in a switchboard as positively as a magneto through 600 ohms line resistance. The receiver is not as satisfactory as a call bell but central's ring can be heard distinctly for some distance as a series of clicks.

As already mentioned, two or more buzzers can be cut in on a line already being utilized for Morse transmission by throwing the line condenser switch in. Neither method of operation will interfere with the other. It is understood that the buzzer must be connected between the line and the ground and not cut into the line series.

DRY CELLS.

18. The operation of the buzzer depends much on the condition of the dry cells used with it. Dry cells deteriorate in storage and, in general are unserviceable after six months. The date on which each battery is installed in a buzzer should be plainly marked with an indelible pencil on the battery.

The general tendency is to blame any failure of the buzzers on the dry batteries, throw these away without test and substitute new ones. This practice should be rigorously checked and all questionable batteries should be examined to see that their terminals are clean and bright, and that the spring contact between the two cells inside the paper tube is sufficiently strong to properly connect the two cells in series. This may be done by sliding one or both of the cells out of the tube.

S. of F. for F. A., March, 1915.

Drill Regulations, Field Artillery—Paragraph 168.

1. With the origin at the middle of the upper edges of the shield the divisions should be for the average case with the 3-inch field gun. 6, 12, 18.1 and 24.5 inches from it to indicate divisions of 50, 100, 150 and 200 mils respectively. The middle of the top of the tire is at approximately the 250-mil division.

2. A shift of the trail by the width of its mark in the ground corresponds to a change of direction of about 150 mils.

3. A shift of the trail by the width of the present float corresponds to a change of direction of about 220 mils.

S. of F. for F. A., May, 1915.

Data Relative to the Time Element in Field Artillery.

1. During the past term at the School of Fire, an endeavor has been made to gather data as to the effect of the use of telephone or buzzer upon the interval required to transmit firing data orally; as to the time necessary for officers to get off their commands after the last burst of a salvo; as to the time required for service of the ammunition and piece, etc. The data are limited in quantity, are derived mainly from the use of platoons, apply only to fire for adjustment and involve the use of a personnel varying from low to high efficiency.

2. The average time required by conductors of fire from burst of last shot to enunciation of the range varied with individuals from 3.41 to 17.02 seconds. The mean time was 9.34 seconds. Analysis of results indicates that an average time of four seconds or less is excellent, of from four to seven seconds is very good, of from seven to ten seconds is good, or more than ten seconds is poor.

3. The average time required to transmit data by phone varied from 2.5 to 19.25 seconds. The mean average was 7.13 seconds. It is estimated that a mean of 6.31 seconds should be satisfactory.

4. The use of the buzzer was slower than the telephone by about twelve to thirteen seconds.

5. The average time from announcement of range at the battery to firing of the first round was 8.56 seconds.

6. The average time required to set a fuse when the projectile is in the fuse setter and to serve the round to the gun is about 5.486 seconds, based on 400 trials evenly divided between eight gun squads.

CONCLUSIONS.

7. (a) The battery commander should be close to his battery whenever possible and should be provided with a ladder to use when necessary.

(b) Buzzer communication appeared to be more accurate than telephone. A faster letter code must be developed, all unnecessary signals must be eliminated and instruction must be thorough to make operators expert.

(c) The fuse setter must have more easily read scales and its manipulation must be made faster and certain.

(d) Officers must be trained to rapid decision and to the use of distinct and smooth commands synchronized with the telephone or buzzer operation.

(e) Telephone operators with resonant, carrying voices of clear enunciation must be selected.

(f) Paragraphs 380 and 281, F. A. D. R., as changed, must be explicitly obeyed in order that cannoneers may learn to apply data without waiting for its repetition.

(g) It is suggested that battery commanders extemporize means by which they and their executives can wear and use the telephone without intermediaries.

School of Fire for F. A. May, 1915.

EXTRACTS FROM FIELD ARTILLERY NOTES, ARMY
SERVICE SCHOOLS, FORT LEAVENWORTH, KANSAS,
DECEMBER, 1914.

Organization.

Artillery, embracing as it does guns, teams, and personnel, is difficult to organize. The United States is the only country that keeps a large percentage of its caissons horsed and manned in time of peace. Germany has none with the light artillery, and only two with each horse battery; Italy and Russia have none with either, Austria and England have two with each. In other words, the countries that must make their frontiers at a week's notice rely on impressed teams for their ammunition supply, and are thereby enabled to increase their supply of firing batteries, while we, with a wholly inadequate force of firing batteries, count on the creation of whole batteries after war has begun. On a peace footing the European countries mentioned average one gun to twenty-one enlisted men. We have one gun to thirty-three enlisted men. On a war footing these ratios are more nearly equal. The lack of a proper reserve system in this country is the principal reason for the different organization.

In all countries the battery is the firing, the battalion the tactical unit. Generally speaking, the more recently armed countries have 4-gun batteries. Russia is the only one having an 8-gun battery, but it is really a tactical unit, a battalion, for it is commanded by a lieutenant colonel and is formed by two half-batteries, each commanded by a captain. Nearly all horse artillery is organized into 4-gun batteries.

Howitzers have come into general favor in late years and are found in varying numbers in the divisional artillery of all armies. Their battery organization is similar to that of the light artillery and of about the same strength.

The requirement that the division shall be a complete tactical unit, able to meet any requirement of field service, compels its artillery to be able to meet any condition that mobile field service may impose, hence the necessity for howitzers with their high-angle fire. Gun fire is but little effective against field works, while the latter are in constant use in both defensive and offensive warfare.

Artillery is easier to organize than cavalry but harder than

infantry, and military countries base their systems on this fact. Horse artillery is more nearly akin to cavalry in this respect, and for this reason is usually more nearly maintained at a war footing in peace.

The battalion varies in strength from two to four batteries; and in some countries is the highest unit short of the brigade. It is known by various designations, "groupe" in France, "abteilung" in Germany, and "brigade" in England. The most common organization is the battalion of three batteries, the regiment of two battalions, the brigade of two regiments. There is no objection to this two-unit organization, such as obtains in the case of infantry or cavalry.

Sub-Note "A."

In 1866 Prussians and Austrians had about 3.1 guns per 1,000 total strength; at Koniggratz the former had 3.54 or 5.0 per 1,000 rifles, the latter 3.7 or 5.5 per 1,000 rifles. In addition, a larger percentage of the Austrian artillery was put in action and it made itself famous that day. A complete reorganization—resurrection, one might say—of the Prussian artillery followed.

During the campaign of 1870, the French had 2.6 guns per 1,000, but this was really 3.3 guns per 1,000 of their actual strength. Partly because of unreplaced losses in the infantry, and partly because of an increasing appreciation of the value of artillery, the percentage steadily rose. The German 10th Corps, for example, had 4.16 guns per 1,000 at Vionville, 5.8 about the time of the surrender of Metz, and 6.4 at Beaune la Rolande. The 3rd Corps entered the war with 4.6 guns, and at its end, in the battle of Le Mans, had 5.8 guns per 1,000 men. A Bavarian corps artillery grew to 11.1 guns per 1,000 men. Needless to say, any great change from an adopted standard in the ratio of guns to rifles gives rise to serious questions of supply, of transport, of position of artillery in the column, of preliminary dispositions for battle, and of the conduct of the battle itself.

At the present time the German corps has 5.76 guns per 1,000 rifles, the cavalry 3.3 guns per 1,000 lances. If the heavy artillery are included, the corps has 6.4 guns per 1,000 rifles.

The French proportion is 4.8 guns per 1,000 men, the British 5.9 guns. In the United States service, the proportion in the infantry division is 3.1 per 1,000 infantry rifles in the cavalry division, 3.46 guns per 1,000 rifles.

Over strength in artillery undoubtedly tends to making a division unwieldy and clumsy, weakness in artillery improves mobility and maneuvering power. The latter are particularly essential qualities in the cavalry, yet the division of that arm is decidedly strong in artillery. Foreign services generally put from 3 to 3.8 guns to 1,000 sabers. The infantry division, on the other hand, is rather lightly equipped with artillery. An economical means and a good one, from a tactical point, to correct this, would be to add a battalion of light howitzers to each regiment of light artillery, giving 4.6 guns per 1,000 rifles. For horse artillery, on account of the peculiarly dispersed methods of the cavalry division, a regiment of four batteries in two battalions might very readily prove a more efficient organization than the present one of six batteries.

* * * * *

Field Artillery on the March.

Rate of March. Paragraph 537, Drill Regulations, Field Artillery, gives the maneuvering walk as 4 miles an hour, the trot as 8 miles an hour, and the gallop as 12 miles an hour. It also prescribes a slow trot at 6 to 6½ miles per hour and the canter at 8 miles per hour. Nowhere is it stated what may be expected of artillery on the march.

The Field Service Regulations state that the march of artillery is the same as that of the command of which it forms a part, if alone it covers 15 to 20 miles.

In most countries, standards are set to which all units are expected to attain. Some of the more important are mentioned.

France—marching alone, 5 miles per hour and from 19 to 25 miles without requiring any extended rest; horse artillery, 5.6 miles per hour and 25 miles.

Italy—three to five miles per hour and 19 to 25 miles per day. In forced marches it is supposed to be equal to 50 miles a day.

Austria—9 to 15 miles per day; in a forced march with infantry, 28 miles per day, and in the same with cavalry, 38 miles per day. Alone it moves at the walk and trot, in the zone of battle only at the trot, at the gallop only in line and under the most favorable circumstances and for not to exceed 550 yards at a time. The trot is limited to 20 minutes at a stretch.

Russia—three to 3¾ miles per hour at the walk, 4½ to 5½ at

the trot. Marching alone it covers 20 miles in 5½ hours, horse artillery 37.5 miles in the same time. Mixed commands are expected to cover as gallop, maximum, 19 miles in from 7.5 to 9 hours. Horse batteries alone use the gallop.

The English give 4 miles as a good average gait, 30 miles as fine work, and 40 miles as a marching requiring a day's rest after it.

In most services, our own included, the gallop is going out of fashion. It is useful in bringing up guns that have dropped behind and in crossing danger zones. But it is an unnatural gait for a draft horse, and the horses' shoulders get pounded badly, usually more time is lost in the confusion of going into position at a gallop than is saved, and accidents to matériel are too frequent. It is a relic of the days when the gun was a practically indestructible tube of steel on an equally simple and inexpensive carriage, and has little place with the very expensive and complicated machine the artillery uses today.

Most of the marching in peace is with empty limbers and caissons, and false ideas develop therefrom. The batteries of horse artillery now at El Paso are trying to set a rate of 25 miles in 6 hours. One of them did it repeatedly in five hours, but on two marches of over 100 miles the rate fell to an average of 7.5 hours, though an actual marching rate of 5 miles per hour was maintained. Days were hot, nights cool, roads poor but hard, except in some sandy stretches, and nearly level.

In general it may be said that our artillery is as mobile as that of other nations, can keep up with the troops with which it should properly march, will go forward to position at the trot, and will occupy position at the walk when possible, otherwise at the trot, almost never at the gallop.

The 3.8-inch howitzer has the same mobility as the 3-inch field gun. The mountain gun and mountain howitzer, except for very-short distances, can only move at the walk, but they have been known to make from 4.5 to 5 miles an hour for long distances, at that. Heavy field artillery moves at the walk only, though trotting is not beyond its powers for short distances on good ground, and the 4.7-inch howitzer is credited with the same mobility as the light artillery when equipped with eight-horse teams as it is when serving as divisional artillery.

It is to be noted that countries famous for their fine roads expect much more from their artillery than others. Russian roads approximate those of the United States.

TABLE OF ROAD SPACES OF FIELD ARTILLERY.

| Unit | Light, Yards | Horse | Moun tain | 4.7-inch Howitzer Divisional | 4.7-inch Howitzer Army | 4.7-inch Gun | 6.0-inch Howitzer Fixed |
|------------------------------------|-----------------|-------|--------------|------------------------------------|------------------------------|-----------------|-------------------------------|
| Battery | 400 | 460 | 358 | 528 | 444 | 540 | |
| Firing battery | 220 | 260 | 185 | 290 | 250 | 300 | |
| Combat trains | 196 | 220 | 193 | 258 | 214 | 264 | |
| Battalion | 1310 | 1490 | 1184 | 1146 | 978 | 1170 | |
| Battalion, less combat train | 770 | 890 | 665 | 670 | 590 | 690 | |
| Combat trains, battalion | 588 | 660 | 579 | 516 | 428 | 520 | |
| Regiment | 2800 | 3160 | 2548 | 3658 | 3154 | 3730 | 3530 |
| Regiment, less combat train | 1720 | 1960 | 1510 | 2230 | 1990 | 2290 | 2190 |
| Regiment combat trains..... | 1176 | 1320 | 1158 | 1584 | 1284 | 1560 | 1468 |

Positions of Artillery in the March Column. It has been said with reference to the Manchurian campaign, "that a battery seen is a battery lost," this referring, of course, to a battery in movement. The catchy phrase has been repeated by writers on the Balkan wars, and bids fair to become an axiom. It is evident, then, that reasonable precautions should be taken against artillery being marched or maneuvered within range of hostile artillery in position. When the general line of a hostile position is known, this is a simple matter. The terrain will usually afford some cover up to the positions where it is desired to place the guns, exposed ground can be covered rapidly, and if conditions are too bad, darkness can be awaited.

In the Balkan wars the Bulgarians seemed to rely on long distance firing, frequently up to 5,000 yards. The Servians, on the other hand, advanced over even the roughest ground, largely by manhandling, under cover of darkness, from 1,500 to 2,000 yards in a night, until suitable ranges were attained. Their example is good.

At Yenitze-Yardar the Balidza Bridge was covered by Turkish artillery at a range of about 6,800 yards. There was no other crossing, and the artillery of the 2nd and 3rd Greek Divisions would not attempt the bridge by daylight. The attack of the divisions was consequently postponed until next day. Yet the Turkish matériel was not of the best in the world and by all accounts was rather indifferently served.

Rather than cross an exposed area, all the Allies used extreme ranges or waited for darkness. It must be remembered, however,

that speed was out of the question by reason of the rough country, wretched roads, and poor draft animals. But the fact remains that their caution was the direct outcome of batteries being practically destroyed when caught in movement.

In the case of marches in the presence of the enemy, the above considerations seem to demand that no artillery shall be within range of the limit of the ground covered by advance and flank guards or other covering detachments. In the general case such a condition is impossible of attainment, and it is undesirable. Fancy requiring assurance that the country for a width of eight and a depth of four miles is free from hostile artillery before ours may turn a wheel! And if hostile artillery is encountered by a covering party, messages must be sent from four to six miles to the artillery, which must make its way under cover from two to four miles to attack. It reduces to the absurd.

The artillery must take its chances at marching and maneuvering in the presence of the enemy, as other troops do, and like them, it will occasionally suffer grievous losses. Quick thought and action, applied to a well-trained battery, will tend to minimize losses, just as in the case of other troops. Its ability to escape or to gain cover, when in a tight place, is scarcely comparable with that of infantry and cavalry. But one can readily conceive one battery delaying a minute to cut through a wire fence, and getting riddled by shrapnel, while another goes through it at a run and escapes with a few scratches.

The value of artillery in the early stages of an attack was much impressed upon the Germans by their enemies, the Austrians, in 1866. They promptly reversed their former system of keeping the bulk of the artillery in the rear on the march into action, and pushed as much of it as possible well to the front. This was their system when they entered the War of 1870, and the artillery became the pride of the army and nation by reason of its achievements. But the rule they formulated was much varied in its application, and columns were found wherein battalions of artillery were sandwiched between infantry units throughout. No doubt, good local reasons existed for these formations, and this is the crux of the whole matter.

Assuming that "a battery seen is a battery lost," and also that in case of contact with the enemy artillery must be at hand, a careful consideration of local conditions, terrain, roads, weather, troops, as

they affect both ourselves and the enemy, will enable the most advantageous placing of the artillery in respect to the two requisites, security and availability.

The principles governing the formation of advance guards apply in general to the placing of the artillery. In close country distances are reduced, in open country the security and freedom of movement of the main body can only be assured by an advance guard of great depth. Probable early opposition may call for strength, an intention to draw the enemy out on other ground than he occupies may reverse this need.

The Field Service Regulations advise that in open country the advance guard should be strong in cavalry and field artillery. This is qualified by the statement that a force not stronger than a brigade of infantry would seldom put artillery in its advance guard, and that a regiment of infantry would not ordinarily have artillery assigned to it.

Where conditions warrant attaching artillery to a regiment of infantry it will be best placed, usually, at the rear of the main body.

In a suggested formation of an advance guard for an independent division, the depth from point of advance cavalry to point of advance party is given as at least four or five miles. From the point of the advance party to the head of the reserve is 2,800-3,000 yards. The reserve is headed by a battalion of infantry followed by a battalion of artillery.

If we consider this advance guard as an independent detachment there would be no better reason for placing one of the batteries with the support (now the advance guard), than there is as it stands. If it were so placed, it would be at the tail of the support, about 1,200-1,300 yards in advance of its present position. It is that much farther into the dangerous zone, has that much less maneuvering space, and the only advantage gained is that it can come into action where it is about five minutes sooner than if it were with the main body. This advantage is slight in comparison with the two disadvantages mentioned.

A similar model of the advance guard of a British division gives two battalions of infantry (one-sixth of the total) and one battery as the strength. This is six guns and 2,000 rifles, as against twelve guns and 5,000 rifles in the American. The former thus has a larger proportion of guns to rifles than the latter. The main body is

headed by the two remaining battalions of the first brigade of infantry, then comes all the artillery (less combat trains), then the other two infantry brigades. The distance between advance guard and main body is three miles.

Attaching one of our batteries to a regiment of infantry gives a ratio of 2.3 guns per 1,000 rifles, less than the proportion the British consider permissible.

But it is not the proportionate strength that determines whether a small infantry command should have artillery attached to it. It is the mission of that command and the relative weights of the advantages and disadvantages of using artillery in the accomplishment of that mission. A very small force of infantry might effectively cover very important action by a relatively large force of artillery, and in any case necessity for artillery action may outweigh the chances of losing it.

In flank guards the same general principles govern the placing of the artillery in the march column, but here the opportunities will be more frequent for placing the artillery on a road by itself on the flank toward the main column.

In rear guards, more than in advance or flank guards, local conditions must govern the placing of the artillery. Usually it will be in much greater proportion, more is known of the enemy, the country is familiar, successive positions can be reconnoitered and prepared for occupation far in advance, defiles that the enemy must use can often be best held by artillery fire from a distance. In retreat from action, the artillery is likely to do much marching alone, progressing by rapid dashes from one position to another.

Pursuit from the battlefield, while it may begin by a general cross-country advance, will soon resolve itself into attacks against well-defined positions in which the hostile rear guards seek to check the pursuit until their main forces get away in march columns on the best roads leading to the rear. The whole force of the victor cannot be utilized, for it will require supplies, ammunition, etc., and besides, once the retreating force gets in column on the roads he will distance a pursuer who sticks to cross-country. Once his columns are well under way, his rear guards will no longer contest the pursuit closely, but will make sudden moves to selected positions farther to the rear, there to prepare for another stand, or perhaps to find them occupied by other troops, and orders waiting to join the main body.

The pursuer will have started with strong artillery, but after the first rear guard position has been evacuated by the pursued, conditions are quite likely to call for what might be termed a normal formation for a march in the presence of the enemy.

Artillery Positions.

Direct fire requires an unmasked position, indirect fire may use either a masked or unmasked position. Because of the advantages of indirect fire and the freedom allowed artillery in the choice of position in target practice, fake ideas develop. It is customary to put the battery in the most advantageous position to cover the assigned sector and to establish the observation station on the nearest commanding height. The country selected for target practice is generally very open, bare, in fact, and not at all resembling the terrain over which battles are usually fought, viz: farming regions, with all that implies of hedges, groves, orchards, fences, high crops, plowed land, drainage ditches, streams, reservoirs, buildings, etc. In such country animate targets will be rare, natural or artificial objects where the enemy is known or believed to be will be the ordinary targets. Perfect view, easy observation, ability to reach any target, rarely will these be combined in any one position.

Besides, on a large scale, the division is restricted to a comparatively narrow front, all the batteries must be utilized, and rarely indeed will any terrain afford equally good positions for all.

There are two real essentials about an artillery position: It must be within range of the enemy and it must be possible to lay upon him. And such a position can always be found even though it may be in the infantry firing line.

When opposing troops come into contact, that is, the infantry are within effective rifle range, the parts of the line are certain to advance irregularly, due to various causes. Some will meet with less opposition, others will find better cover, others will have more dash. The result is that it becomes increasingly difficult for the artillery to appreciate where its help is most required. If both sides are mobile, both aggressive—probably the most usual case—as they close the lines will be still more irregular, a local success not followed by a counter attack there, and distant artillery fire becomes more or less impossible. The artillery must get where it can exert an influence on this fighting and then the unmasked position and

direct fire will be the rule. Mountain artillery is particularly suited for such work.

Requirements of a good position:

Effective range to every prospective target position.

Good view of every prospective target position.

Concealed approaches.

Concealment for guns.

Concealment and cover for limbers and combat train.

Difficult to range upon.

Easy to intrench.

Little dead space in front.

Soil not favorable to action of hostile shell or shrapnel, but sufficiently hard for gun platforms.

The masked position has decided advantages in the attack of a defensive position. The defenders lines are taken up with a view to holding them and the attacker soon locates them. The necessity of clearing the field of fire for his Infantry compels him to betray its position and renders it easy for the attacking artillery to cooperate with its Infantry in attack, and to anticipate and repel counter attacks.

An advantage of the masked position is that the enemy can never be sure of its strength and location even with aerial observation. A few bushes about the carriages to break up sharp lines and keeping the personnel underneath, will insure the air scout missing them until their fire is wanted. It thus lends itself to the formation of a reserve of fire power which can be suddenly applied and may be of greatest value.

A favorite trick of the Japanese was to advance batteries under cover of darkness or fog to masked positions within medium range of suspected Russian artillery positions, leaving one or more decoy batteries in not so well masked positions well to the rear. Daylight arriving the decoy batteries would open upon the suspected position. Invariably the Russians would respond to the challenge, and the advanced Japanese batteries would promptly smother them.

Hostile observation of fire against a masked battery is very difficult, often impossible except by aeroplane, dirigible or kite. Lateral observers even with instruments of precision, can do no more than limit the fire to an area containing the target, and one has only to consider the difficulty of dealing effectively with a battery in the

open to realize how relatively hopeless it is in the case of one well concealed. A great advantage of the masked position is that the mobility of the battery is maintained. It will usually be possible to bring up the limbers, spare caissons, reserves, rations, or change position without the enemy's knowledge.

Protection is an advantage, but can only be considered as secondary to effect, and the position must enable the latter to be attained, whether the former is or not.

Much discussion has been had as to whether a position on the covering crest or one some distance in its rear is preferable. The guiding idea of the advocates of the former is that in the event of close fighting the guns can be man-handled to the top for direct fire. But a two-degree slope, one on twenty-five, is about as steep a slope as will permit of the guns being man-handled by their own detachments, and then only on good ground. Flash defilade on such a slope would require the guns to be 100 yards from the crest. Ten minutes would be a short time to allow for man-handling them to the crest, the battery is silent during that time, there are not enough men to bring gun and caisson up simultaneously, therefore, the first one advanced are exposed to observation and fire without being able to reply for at least five minutes.

Again, on such a slope the least range at which the fire will clear the crest is 1,500 yards. A high corrector will enable fire to be maintained to about 1,000 yards if our own Infantry are not on the crest of the forward slope, but then the guns must either advance or remain useless. If advanced, the hostile Infantry being still 1,000 yards away, the hostile artillery has plenty of time to play upon them.

At Liaoyang a battery advanced from its masked position to the crest to cover the retreat of the defeated Infantry. During this movement, it lost one-half of its personnel and was able to bring only three guns into action.

If it comes to close fighting, the battery can cover little besides its immediate front. Any lateral deviation means exposure of the cannoneers.

If the limbers can be brought up, a smart battery should limber up, advance to the crest, go into action again and the limbers clear the line of guns in one minute.

Advantages of the position in rear of the covering crest are that

the dead space in front of it can be reduced or eliminated entirely, a wider sector of fire can be had, mobility is less impaired, ammunition supply is easier, safety is greater, a few hundreds of yards make little difference in the effect of artillery fire, observation is likely to be easier, and if the covering crest is to be occupied it can be done, say from distances up to half a mile, in less time by the use of the teams than by man-handling on the forward crest.

Two cases were noted in the maneuvers of the 11th Army Corps in Germany, 1911, where artillery placed in the infantry line in defensive positions were lost with practically no recompense, while other artillery placed from one-quarter mile to one mile in rear of the line were able to render the position untenable for the assault.

Again, if our infantry is driven back, it need only retire behind the covering crest and there reform, while the artillery sweeps the crest over their heads.

On the whole the odds favor the retired position, but there will be times when either will do, times when the forward position is best; times when the retired is best. It is a matter of judgment for the artillery commander, and the more thorough his knowledge of his arm, and the wider his experience on terrain, the better will his judgment be.

Perhaps the most quoted use of a retired position was one at Taschihchiao. A Russian battery on a level plane, wholly in the open. About 400 yards in front a low crest completely concealing the battery from all points in the Japanese lines. A little to the rear of the battery a gently sloping hill overlooking the Japanese position. In a convenient position part way up the hill the battery commander. For fifteen hours that battery fought six Japanese batteries who sought in vain to locate it, and during the morning it ruined one Japanese infantry attack after another until they quit launching them. Yet it suffered a loss of but two or three men.

A rule of thumb in the German service for occupying masked positions is: Place howitzers a distance in rear of the crest equal to three-quarters times the height of the crest. Post guns sixty meters in rear of the crest for every meter of cover it affords, for ranges 1,000 to 2,000 meters; twenty meters for ranges 2,000 to 3,000 meters; ten meters for 3,000 meters and upwards. Under 1,000 meters they are to be posted more than sixty yards in rear.

The Russians prefer a position retired 400 meters from the

covering crest. Doubtless their opinion is born of war experience and, therefore, entitled to much weight.

The great range of modern guns renders possible the occupation of positions well forward, but intended to fire towards a hostile flank. But such positions will be exceptional, for effective fire is determined by ease of observation. The greater the range the greater the difficulty of observation, and ones own smoke balls are not distinguishable from others.

In level country a hedge or standing grain, orchard, grove, a weed grown fence, may often afford the only cover. A position well to the rear of such is usually best, though one close up or even in front may be preferable. Protection can usually be obtained by intrenching or by the use of sand bags. In the absence of trees, telephone poles, buildings or windmills, the top of a caisson, a ladder or other support aids in observation.

Positions for night firing correspond to those for day. Artillery is of little use at night except to sweep defiles that an enemy is compelled to use. By a careful determination of firing data with reference to points that can be illuminated at night, quite accurate fire can be delivered, but except in the case of defensive works against which our assault is being delivered, or which are illuminated by star shell or searchlights, it will not be known if an enemy is at the point being fired upon.

The Japanese did not hesitate to put mountain guns in the outpost line. They were in the open or intrenched and used at point blank range, practically as machine guns might be used.

Frontage of Artillery Positions.

A firing battery occupies a front of 100 yards measured from center to center of the flank caissons. From center to center of flank caissons of adjacent batteries is forty yards. A battalion, therefore, with normal intervals occupies 380 yards. Between battalions the distance is double that between batteries. Thus 100 yards for a battery, 400 yards for a battalion, 900 yards for a regiment, may be taken as units of measurement for frontages. It is possible, of course, to reduce these, for instance, by making the interval between guns, batteries and battalions the same or by retiring the flank caissons, thus making a single line of guns. In the latter case a battery would occupy sixty yards, a battalion 220 yards,

a regiment 160 yards. Rarely, however, will terrain suitable to such a formation for a regiment be found. Generally speaking the battalion will be the largest unit whose component batteries will be brought into close relation with each other.

The question of observation stations looms very large in this connection. Not infrequently all those of a battalion will be found grouped at one point.

Field Service Regulations state that the frontage of a division acting alone will rarely exceed one and one-half to two miles—2,500 to 3,500 yards—from four to six rifles per yard. In battle line with other divisions the lower limit is likely to become the maximum; 1,800 yards of Artillery then must be accommodated on a front of 2,500 yards, and the chances are slender indeed that all will get suitable positions. Besides if the ground is suitable, the requirements of other troops may limit its availability to the Artillery.

At the Shah Ho the Russian batteries occupied an average front of 600 meters each. The German batteries are considered as occupying a front of 180 meters each. At Mukden the Japanese batteries of the 1st Army, 130 in number, covered a front of nine miles, or about 120 yards per battery.

Rarely will the terrain permit of batteries of light guns being placed in tiers, but it will often be possible to use howitzers and heavy guns from positions in rear of the light guns.

Firing Over Infantry.

This will necessarily be a normal procedure, for the batteries will be scattered over about as much front as the infantry attack covers. It ought not to be viewed with dread. The infantry will not be able to distinguish the noise of its own shrapnel from that of the enemy, and an occasional short burst will pass unnoticed. But the constant appearance of smoke balls over and in front of the enemy's position will be assurance that their own artillery is supporting them. Even at 6,000 yards the error of the gun will bring very few bursts as much as 200 yards short of the target and they will be high in the air and to the infantryman's eye as close to the target as the others. Besides, every man should thoroughly understand that when the charge begins the artillery will advance its fire so that he will not only be safe from it when he reaches the hostile position, but will have only the enemy left in it to deal with. No counter attack will succeed in reaching them.

Position of the Artillery with Respect to the Infantry in Action.—A 3-inch gun has a lateral traverse of seventy mils either way. Hence at 1,000 yards a battery can cover a front of 220 yards, at 2,600 yards a front of 360 yards, at 3,000 yards a front of 500 yards, etc., without shifting trails of the guns. It is not impossible to shift the trails under fire, but it might be impracticable at times, and, of course, in any case involves more or less exposure of the gun squads. This objection is strongest when the guns are in the infantry line, when rifle and machine gun fire is added to that of artillery. As the hostile line approaches, the front that a battery can cover with its fire diminishes till it finally reaches its own front, about eighty yards.

In case of a counter attack by our own infantry, the fire of our guns would almost certainly be blocked at once.

Assume the battery to be 1,000 yards in rear of the infantry line. The latter is stronger by the number of rifles that can be put in the space the battery would have occupied if put in the front line. Questions of fire control, maneuver, ammunition supply, are simplified for the battery, and it remains to be seen if the support to the infantry can be given as well from that position.

At the infantry line, the battery can cover a front of 220 yards, at 1,000 yards to the front of that line it can cover a front of 360 yards. On level ground the height of trajectory above our infantry line would be roughly, 100 yards, perfectly safe for them. The 100 per cent. zone for longitudinal dispersion for the range is about 130 yards. The interval of burst is about seventy yards. A fire then, with a range of 2,000 yards, would give bursts from 1,835 to 1,995 yards from the gun, sweeping the ground from 1,850 yards to 2,200 yards from the guns. But the hostile attack will begin its infantry attack within that area, hence our battery can operate effectively against it without danger to its own Infantry. If the hostile attack continues its advance, our guns can keep up this fire at least until the advance is within charging distance, then if our line is to fall back, the guns can cover the movement and sweep off the advancing enemy, or if it is to resist with the bayonet, the gun fire will be continued against the hostile supports.

That such covering fire is possible may be seen from a study of the action of the shrapnel. Assuming that it would not be desirable to have it burst nearer than 100 yards in front of our trench or position, it must be fired at a range 1,000 plus 100 plus a burst interval

of 50 plus 50 or 1,200 yards, at least. This places the mean point of burst at about 1,150 yards from the gun of 150 yards from the trench, and the ground will be swept from 150 to 500 yards from the latter. The shrapnel will pass about six yards above the defenders, and a premature burst would, of course, be deadly, but just at that particular time, would probably not be noticed.

The chances of firing into our own troops in such a case could be reduced somewhat, and without sacrificing any of the effect on the enemy, by firing with a greater elevation but the same fuze, thereby raising the trajectory.

At 6,000 yards the 100 per cent. zone for longitudinal dispersion is about 400 yards, hence such artillery support could continue until the hostile attack was about 200 yards distant. In this case the mean trajectory is about 125 yards above the friendly Infantry.

Below 1,000 yards the flatness of the trajectory practically forbids such close support, unless the conformation of the ground is favorable. Using the same data as above, it is evident that an advance by our infantry can be supported up to within charging distance in the first case and in the 6,000-yard case, and this will be true of all cases falling between those.

When the charge begins, the artillery keeps up its fire merely increasing the range gradually, interposing a barrier to the advance of hostile supports of the development of a counter attack. This is called "advancing the fire."

It may be assumed that our charge will advance about 150 yards per minute. Assuming our guns firing at 2,000 yards. As the charge is seen to begin, three or four volleys are fired at 2,100, followed by three or four more at 2,200, after that observation would determine what to do.

It must be remembered that only in adjusting fire may serious errors on the part of artillery personnel be expected. Great changes in the setting of instruments renders errors likely. Once fire for effect is begun, the changes are small, sometimes none at all for many rounds, and regularity is assured. The error of the gun only need be considered.

Granting reasonably good observation then, our artillery firing over our infantry, from positions 1,000 yards in rear, can defend it against hostile Infantry until the latter comes within charging distance, or can support our attack until it arrives within charging distance of the enemy.

The first part of this statement is of particular importance in the taking up of defensive positions. Such a position presupposes weakness and an intent to make the terrain and artificial obstacles, as well as dispositions, help out, and in the general case a battery's place of possible maximum usefulness is somewhere at least 1,000 yards in rear of the line of trenches. In offensive action the necessity of getting within suitable range of the hostile positions will usually govern.

EDITORIAL DEPARTMENT.

The Weight of the Projectile as a Foundation for Our Field Artillery Ordnance System.

The board of officers recently convened by the War Department to "consider questions concerning the types of field guns and ammunition supply therefor" will have before it problems so numerous, so varied and of such vital importance to our national defense that it is neither possible nor proper to attempt to outline them at this time. The work before the board involves a modification of the present policy in field artillery guns and ammunition that must not only take full advantage of all reliable information received from Europe, but must at the same time utilize to the greatest possible extent the ordnance we now possess, prevent the further manufacture of that which is without practical utility and present to Congress a progressive project which shall be both comprehensive and convincing.

There is one lesson which the European war has driven home in such a way that we cannot overlook it. The importance of heavy field artillery has been recognized and utilized to an astonishing extent. This employment of heavy field artillery has emphasized the absolute necessity for obtaining a range at least as great as the corresponding guns to which one is opposed.

In this country we are to a limited extent supplied with heavy field artillery of modern design; but the adopted system of field artillery ordnance, including both light and heavy types, is based upon the fact that any gun may have as a companion piece of *equal mobility*, a howitzer firing a projectile twice as heavy as that of the gun. From this it follows that the weight of our field artillery projectiles increases by geometrical progression. The 3-inch gun fires a 15-pound projectile, the 3.8-gun and howitzer a 30-pound projectile, the 4.7-inch gun and howitzer a 60-pound projectile and the 6-inch howitzer a projectile weighing 120 pounds.

In the determination of the types of guns to be supplied to a mobile army we should consider not only the weight of the projectile, but the use to which the guns are to be put and the range at which they can attack and be attacked. A case in point is our 6-inch howitzer which is a very superior piece of ordnance if its range

and mobility are not considered. The weight behind the team is 8,611 pounds, which is approximately the same as that of the 1.7-inch gun. As regards mobility there is little difference between the two types; and one might expect that they could properly be used as companion pieces, the gun to be employed when a flat trajectory was desirable and the howitzer when plunging fire was required. But the 4.7-inch gun has a maximum range of approximately 11,000 yards, whereas the 6-inch howitzer has a maximum range of 6,704 yards or less than that of the 3-inch gun even on its present mount. It is thus seen that the 6-inch howitzer cannot be used as a companion piece to the 4.7-inch gun but must be brought up to within light artillery range. This subjects it to liability of capture, or of being overwhelmed by the more rapid fire of hostile light artillery. In fact, the range of all the howitzers in the system is too small.

It would appear that if progress is desired, one of the most pressing needs of the field artillery is a thorough consideration of the inter-relation of range, power and mobility in our existing system, and a modification of that system to insure the proper tactical employment of any given gun or howitzer.

The 3.8-Inch Gun and Howitzer.

There is another important consideration in regard to the types of field gun required by a mobile army which involves the practical utility of our 3.8-inch guns and howitzers.

It is believed that it should be determined whether or not the practical utility of the 3.8-inch gun and howitzer justifies the multiplicity of calibers involved in their retention and further manufacture. If their range, power and mobility are such that they can do work which is essential to the success of a mobile army and which cannot be done by any other types they should be retained. But they have no proper place in our system if they are simply a geometrical link in the chain upon which our field artillery ordnance is hung without being tactical necessities.

The Needs of the School of Fire.

Before the School of Fire for Field Artillery was established at Fort Sill, in 1911, the technical training of our field artillery officers depended entirely upon chance. Some officers had no training at

all. Like Topsy, they "just growed." Others were fortunate enough to serve under superiors who were able and willing to impart the knowledge which they themselves had acquired solely through their own efforts. But there was no system whatsoever. It was apparently a matter of indifference to the War Department whether the field artillery was able to make good use of its matériel or not.

The establishment of the School of Fire marked the beginning of a new era. It made technical training compulsory, and inaugurated a system through which an opportunity was given to officers of all grades to demonstrate their ability to conduct fire. The beneficial effect was soon felt throughout the service. Officers of infantry and cavalry who have had opportunity to see the results of the School of Fire have been impressed with the fact that at last the field artillery was beginning to be able to give them proper support and to deliver effective fire promptly.

At first the methods of the School of Fire were the subject of much discussion and criticism. This was to have been expected. Field artillery technique will always furnish subjects for discussion. If this were not so our development would be at a stand-still. But even those officers who differed the most strongly with the methods of the school recognized the good that it was doing. It was evident to all that the field artillery had been given an opportunity to shoot and to find out how to hit. It would be difficult to estimate the extent to which the professional standard of field artillery officers has been raised during the past four years. The full effect of the establishment of the School of Fire, however, will be seen only when the second lieutenants of today command the batteries of tomorrow. The day of haphazard methods and accidental efficiency will then have passed.

But although the good results of the School of Fire are generally well understood, few officers realize to what extent the physical needs of the school have been neglected. It was natural that little could be done for it during the first few courses. The school was an experiment, and its needs were not defined. Gradually, however, the requirements of the school became apparent. A commandant and a teaching force free to spend all their energies on their school work, instruction batteries wholly available for school firing, lecture rooms, barracks, quarters, stables, store-rooms and machine shops—all these were seen to be essential to the success of the institution.

The facilities which were at first furnished in the old post at Fort Sill were soon outgrown and were increased by quartering the School of Fire in unoccupied buildings in the new post. Under these conditions the school would have been able to carry on its work in a comparatively satisfactory manner until such time as permanent buildings designed especially for its use, could be provided. Changes in the garrison at Fort Sill, however, made it necessary to move back to the old post in the midst of the fall term of the school in 1914. The school which had outgrown these quarters was forced to accommodate itself to them under very trying circumstances. Recently the necessary requirements of the School of Musketry forced the School of Fire out of the old post. It is now proposed to utilize the old post trader's store between the two posts as a School of Fire. This building is old and inadequate. It is located on the site proposed for the permanent buildings. The School of Fire for Field Artillery is practically homeless. Unless immediate provision is made to provide adequate quarters it will be impossible to continue the work already undertaken, no extension will be possible, and much of the good already accomplished will be neutralized.

It would be futile to discuss any details connected with the rehabilitation of the School of Fire; but it is evident that it cannot continue unless it is properly organized, efficiently administered and decently housed. Expedients and makeshifts which were permissible in the beginning should have no place in the present deliberations. If the field artillery is to any encouraging extent ready to be put to the test of conducting fire under service conditions it is because it has begun to learn the use of its matériel at the School of Fire. To neutralize this increased efficiency by failing to provide the necessary physical equipment will be nothing short of folly.

It is hoped that Congress during the coming session will make appropriations sufficient to establish the school on a permanent basis.

The Influence of the Range Finder.

Ever since the present form of self-contained base range finder has been in use with service target practice there has been a growing feeling that its adoption and issue would have an important effect in modifying the methods of fire. In this number of the FIELD ARTILLERY

JOURNAL, Capt. Leslie J. McNair has presented a most careful and convincing exposition of what the Goertz range finder has accomplished at the School of Fire and what may be expected of it in the service at large.

Capt. McNair's conclusions, as expressed in the article referred to, include the following:

(a) Against fixed targets, use a range change of 200 yards until a bracket or effective range is obtained.

(b) Against moving targets, wait for the range finder range or a report that it cannot be obtained. Open fire at the range finder range; and, after observing this range, assume that a 400 yard bracket has been determined and fire for effect beginning at the appropriate limit. In the case of very rapidly advancing or retreating targets, the assumed brackets may best be taken as 500 yards when the first range is observed in the sense *away* from which the target is moving.

These conclusions are arrived at after thorough research and trial. They are based upon both practice and theory. They plainly call for an extended service test which may result in a widening of their scope to include the attack of fixed targets in a manner similar to that suggested by Capt. McNair for the attack of moving targets. But it is not believed that, as suggested by Capt. McNair, any authority for an extended service test is required under existing regulations. When the range finder is issued to the service, commanding officers should feel free to make use of the information which Capt. McNair has compiled, to put into practice the methods which he suggests and to develop such extension of these methods as will enable the field artillery to take full advantage of this instrument which promises in many ways to revolutionize the adjustment of fire.

Drill Regulations and "Changes".

Although we have indicated above that no special authority to give the range finder a service test is believed to be required under existing drill regulations as amended, it is evident that the range finder, the aeroplane and the rapid development of field artillery methods due to the war in Europe will soon involve further changes in drill regulations, and that change will follow change indefinitely.

This is not to be wondered at. The employment of field artillery is a rapidly progressing science.

To facilitate the adoption of such modifications as meet with the approval of the War Department some better method appears to be called for than the publication of a series of "changes" to be incorporated in existing drill regulations. To get full value from any published "changes" it is necessary to paste them in copies of the drill regulations. There is seldom any assurance that the copy in use at any given time has been properly amended. This phase of the situation is particularly objectionable when inexperienced officers or enlisted men are concerned. If the Militia Field Artillery should be reorganized or increased or if it should be necessary to raise volunteer troops the confusion resulting from our present system would be limitless. Another objection to the present method lies in the great delay involved in publishing an edition of "changes," and the fact that in some cases the latest editions are not consistent with those of a prior date. This is exemplified by "Changes No. 4, Field Artillery Drill Regulations," published March 18, 1915, which contains a letter code for semaphore signaling which includes code letters for commands made obsolete by "Changes No. 3," published February 6, 1915, and does not contain code letters for the corresponding new commands.

On page 605 of the FIELD ARTILLERY JOURNAL for October-December, 1914, it was suggested that it might be possible to avoid delay and confusion by publishing a semi-permanent "Drill Regulations," omitting all reference to the preparation and conduct of fire, field artillery service and artillery in the field. Such a book might reasonably be expected to remain in force for several years. The omitted portions are all unavoidably and very properly subject to frequent changes. They might well be covered in pamphlet form and changed periodically by the publication of a new pamphlet on the same subject. Each pamphlet should supersede all previous pamphlets.

Unless this or some similar method of keeping field artillery drill regulations up to date is adopted we shall either see many needed improvements delayed through fear of publishing too many formal "changes" or else frequent "changes" will be published and the existing confusion greatly increased. It is believed that this is a matter which merits the careful attention of the War Department.

Marine Corps Field Artillery.

Capt. Robert O. Underwood, U. S. Marine Corps, has shown us in his article in this issue that during the past three years the Marine Corps has made remarkable progress in the training and employment of field artillery. The Marine Corps is the only portion of the military forces of the United States which has had an opportunity of using modern field artillery matériel in an action. This is not only historically interesting, but it also indicates the possibility that in the future the Marines, from every nature of their service, may be the first to employ in time of war the methods which we are all endeavoring to perfect in time of peace.

For this reason, so far as the conduct of fire is concerned, it is important that the development of field artillery should proceed along similar lines in both the Army and the Marine Corps. There should be no working at cross-purposes and no wasteful diversification of effort. The problems of organization, transportation, supply and tactical employment will necessarily remain almost entirely separate and distinct for the two forces; but both forces should as far as is practicable unite in their efforts to solve the complex problem of conducting fire.

The participation of officers of the Marine Corps in the instruction at Tobyhanna during the current season should serve to stimulate an interchange of ideas and a healthy spirit of competition and professional rivalry. The Marine Corps is fortunate in being able to cut their pattern from whole cloth. It is hampered with none of the moss-grown customs which have done so much to retard the development of field artillery in the Army. The Marines are thus often in a position to discuss our problems with us from a refreshing original viewpoint. Their well-merited reputation for energy, resourcefulness and initiative will tend naturally to make them eager to take the shortest path to the desired result. At the same time it is to be remembered that although the field artillery of the Army has not taken full advantage of its opportunities during the ten years which have passed since the adoption of the 3-inch gun, it has yet been able to overcome many of the obstacles which inevitably stand in the way of a force which has more recently undertaken similar tasks. In giving the Marine Corps the benefit of such lessons as the field artillery of the Army has learned, the further progress of both services along advanced lines may be expected

as the result of combined effort coupled with a free exchange of ideas and experience.

Not only should a friendly spirit of mutual helpfulness in field artillery methods be built up, but also every effort should be made to insure constant cooperation between the War and Navy Departments in order that there may result the desired amount of standardization of matériel and equipment. Only in this way will duplication of expense and effort be avoided, the cooperation of the two forces in the field be made possible, and a field artillery service worthy of the nation be built up and fostered.

The National Security League.

The National Security League has been incorporated for the purpose of furthering the following program:

1. Legislation correcting present wasteful methods of military appropriations and disbursements.
2. The adoption of a definite military policy.
3. A stronger, better balanced Navy.
4. An effective mobile Army.
5. An adequate National Guard organized under the War Department.
6. The creation of an organized Reserve for each branch of our military service.

This program is based upon the principle that, since there is no assurance that the United States will not again become involved in war, and since a peaceful policy supported by treaties is not a sufficient guarantee against war, and since we are not properly prepared to maintain our national policies due to the fact that there has been a lack of cooperation between Congress and its military and naval advisers, it is necessary for the people of the United States to insist that Congress undertakes adequate military preparations for the defense of the nation.

Such a program, based on such principles, is worthy of the generous support of every patriotic citizen.

New Cover Design.

We are indebted to Capt. Pelham D. Glassford, 1st Field Artillery, for the new cover design which appears with this issue.

INDEX

TO CURRENT FIELD ARTILLERY LITERATURE.

Compiled from weekly lists furnished by the War College Division, General Staff.

Officers requesting information will please quote fully, giving the subject matter carded. When a book is designated, the title will be given in the same language in which it is printed.

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- Crapouillots—(France).*—The "Crapouillots" used against the Germans: two Louis-Philippe mortars employed in the French trenches. These old-fashioned mortars are said to cope with the German trench mortars in effectiveness. Two illustrations: one a near view of two, and a view of two in a French trench. (In Illustrated War News. London, part 23, Jan. 13, 1915, 34-35 p.)
- Detonators.*—Gun primers and detonators. A comment and review of an article that appeared in the Revista dim Artigliera e Genio. Engineering, Jan. 15, 1915, p. 85-86.
- Explosives—European war.*—The European war from an engineer's standpoint. III. Modern explosives and their use in warfare. By J. B. C. Kershaw. The characteristics of high and low explosives; the essential chemical constituents of such explosives as cordite, lyddite, ammonal, turpinitite, etc.; a review of field guns, field howitzers, and the heavy siege howitzer used in demolishing fortifications; and the typical features of shells and bombs in use by aircraft. Illustrated. (In Engineering magazine v. 49, Apr. 1915, 43-50 p. TA1. E55.)
- Explosives—U. S. A.*—American production of explosives. The total production of explosives as published by the Bureau of Mines, is given as 463,514,881 pounds (231,757 short tons) as compared with 489,393,131 pounds in 1912. The amounts of black powder, high explosives, and permissible explosives given. (In U. S. Bureau of foreign and domestic commerce. Daily consular and trade reports. No. 256, Nov. 2, 1914, p. 557.)
- Field artillery—Austria-Hungary.*—Strength and organization of field and mountain artillery. Peace and war footing. Armament and equipment; technical accessories; uniform; medical supplies, etc. Table II. p. 2 Heerwesen-Tabellen, V. Pech, Innsbruck, 1915, U672 P36 1915.
- Field artillery—France.*—Notes on the characteristics and tactics of the French field artillery. Memorial de Artilleria, December, 1914, p. 774-778.
- Field artillery—Drill and tactics.*—Employment of covered positions in the field artillery, taking into account the support it ought to give to the other arms in action. (Trans. from Revista Militar Italiana. Vol. V., 1914.)
Revista Militar, Argentine, December, 1914, p. 967-989.

- Field artillery—Drill and tactics—France.*—Enumeration of French rules governing the employment of field artillery. Memorial de Artilleria, January, 1915, p. 117.
- Field artillery—Drill and tactics—Italy.*—Essay on the action of the group commander in the field artillery. With diagrammatic plate. Rivista di Artiglieria e Genio, Feb., 1915, p. 162.
- Field artillery fire.*—Methods of fire direction. Clock-and-finger indication. Methods to be used by the instructor for indicating the target. (In Robinson, Ernest H. Rifle training for war, London, (1914). pp. 12-15, UD330.R65.)
- Field artillery fire—Great Britain.*—Observation of artillery fire by aircraft. "The cooperation of aeroplanes with the fire of batteries." Based on the English regulations for field artillery training, April, 1914. Memorial de Artilleria, March, 1915, p. 370-377.
- Field artillery—Great Britain.*—The interior organization of reserve batteries, Royal Field Artillery (Great Britain). A table giving the organization of a reserve battery. (In Journal of the Royal Artillery, v. 41, Nov. 1914, pp. 537-540. UF2.J5.)
- Field artillery fire—Italy.*—A summary of the chief points in the firing manual of the Italian light field artillery. Mitteilungen Artillerie und Geniewesens, Copy 12, 1914, p. 1332-1347.
- Field artillery matériel.*—British patent No. 25, 517, No. 17, 1913, to Sir A. T. Dawson and another, of Vickers Limited, for a field gun carriage having a divided trail which may be played out for firing, and closed for transport. Two illustrations. (In The Engineer. v. CXIX, Jan. 8, 1915, p. 52. TA1.E48 v. 119.)
- Field artillery matériel—Great Britain.*—A patent granted to Sir W. G. Armstrong, Whitworth & Co., limited, and A. G. Hadcock, relating to field gun carriages that maintain the gun base in an horizontal plane irrespective of the inequalities of the ground. Patent No. 958 of 1914 (British). (In Engineering, v. 99, February 12, 1915, pp. 206, TA1.E5.)
- Field guns—France.*—A comparative study of French and German field guns and matériel. Memorial de Artilleria, January, 1915, p. 80-103.
- Field guns—France.*—Firing table of French 75-mm field gun M/97. Memorial de Artilleria, Jan., 1915, p. 103-106.
- Field guns—France—La Tricoteuse;* a heavy French 120-mm. gun on the Aisne. Stated to be an intermediate size between the "75" and the Rimailho. Illustration. (In The Illustrated war news, Part 29, Feb. 24, 1915, p. 11.)
- Field guns—France.*—"This history of the 75-mm gun." L'Illustration, Feb. 6, 1915, p. 137.
- Field guns—France.*—Article on the fire of the 75-mm. field piece, and the construction of its brake. Illustr. L'Illustration, February 27, 1915, p. 221-224.
- Field guns—France.*—The "Soixante quinze." (French.) An illustrated description of the 75-mm field gun of France, with some details of parts. A sectional view of a percussion fuse used with the gun. (In The Engineer. v. CXIX. Jan. 22, 1915, 77-78 p. TA1. E48 v. 119.)
- Field guns—U. S.*—New designs of mobile guns. A new type of 5-inch field gun and a new type 3.8-inch field howitzer have been developed, especially designed for use with the split-trail types of mounts now undergoing tests, in order to permit of wider traverse of the guns at high angles of elevation. A drop breech used. A new type of 4.7-inch howitzer of wire-wrapped construction for the Panama Canal. Fires at 60 pound projectile, maximum range of 10,000 yards. In Report of the Chief of Ordnance, U. S., 1914, Washington, 1914, p. 27. UF510.3. A15, 1914.

- Fortifications, field—Chile.*—Adaptation of German principles and methods of field fortifications for Chilean army. Text and plates, translated from Lehnert's Handbook for the Troop Commander, pp. 208-213. Manual Para el Mando de las Tropas. U135 C5 L5, Santiago de Chile, 1914.
- Fuses.*—Mechanical time fuses for projectiles. This invention, by Fried. Krupp. A. G. of Essen, Germany, relates to mechanical time fuses with clockwork, the setting of which is performed by the rotation of an external annular setting member surrounding the clockwork. (In *The Broad Arrow*. v. 94, Jan. 15, 1915, p. 64. U2. B8 v. 94.)
- Grenades—Great Britain.*—Hand grenade (Mark I) (Gr. Brit.) General description, use, and methods of throwing. (In *Gt. Brit. War office, Musketry regulations. Part I.* London, 1914. 291-295 p. UD335. G7A2 1914 pt. 1.)
- Grenades—Great Britain.*—British hand grenades (Mark 1). Description and methods of use. Musketry, London, 1915. Filed Ud330 S68.
- Heavy field artillery—Germany.*—A survey of the characteristics and development of German heavy artillery matériel. Memorial de Artilleria, December, 1914, p. 765-773.
- Howitzers—Austria.*—An enemy weapon which fires a shell weighing over 1,000 pounds; the great 12-inch siege-howitzer of the Austrian army. Is capable of elevation up to 65 degrees, recoils 6 feet at each discharge. The barrel weighs 6½ tons, the total weight with recoil equipment and mounting being a little more than 28 tons. Illustration is a near view. (In *The Illustrated London News*. Feb. 13, 1915, p. 193.)
- Howitzers—Germany.*—Artillery. German. Siege howitzers 1914. Description and plates. Reprints and translations. *Journal of the United States Artillery*, Nov.-Dec. 1914, p. 341.
- Howitzers—Germany.*—Calculations of ballistic features of the 42-cm. Howitzer, based upon data as far as known. Memorial de Ingenieros del Ejercito, December, 1914, p. 467-470.
- Mortars.*—Comparative data on fine ordnance pieces of exceptional caliber for curved firing. Memorial de Ingenieros del Ejercito, December, 1914, p. 470.
- Mortars—Austria.*—Information on the Austrian motor batteries of 30.5-cm. guns. With plates. (Transl. from *Allgemeine Automobil-Zeitung*, No. 43.) *Rivista di Artiglieria e Genio*, December, 1914, p. 479-481.
- Mortars—Germany.*—Trials of the German mortar of 30.5 cm., model 1911. An account extracted from the *Jahrbuch für die deutsche armee und marine*. 151 shots were fired at a reinforced concrete target 18m. wide by 9m. in depth, 90 of which hit the target. (In *The Royal Engineers Journal*, v. 21, Mar. 1915, 189 p. UG2. R8.)
- Mortars—Germany.*—The siege mortar, Krupp 42 cm. A short description of the gun and the difficulties of transport. A sketch from sketches furnished by persons who saw the mortar at Cologne. From the *Rivista di Artiglieria e Genio*. Dec. 1914. (In *The Royal Engineers Journal*. Chatham, Apr., 1915, v. 21, 244-245 p. UG2.R8.)
- Mountain warfare—Austria-Hungary.*—Revision of organic data on mountain warfare. *Taktisches Handbuch*, H. Schmid, Vienna, 1915, U165 S347 (bk.).
- Mountain guns—Japan.*—Brief description of the new Japanese mountain gun. *Journal of the Royal Artillery*, January, 1915, p. 718.
- Observation of fire.*—Getting the range. Instruments which make gun fire more effective at distances up to 10 miles. An illustrated article on the methods and manner of observing fire, by periscope, aerial reconnaissance, and range finders. (In *Scientific American*, v. 112, March 6, 1915, pp. 220-222, TA1.S5.)

- Observation of fire.*—Why the flying-man is indispensable to the man behind the gun; how the target is found and the range checked. An illustrated article showing how the fire of artillery is corrected by the use of aeroplanes. The code letters used to signal to the airman when in flight. (In *Illustrated London News* v. 146, Jan. 23, 1915, p. 107.)
- Observatories—Great Britain.*—A traveling observatory for horse or field artillery. A British patent granted to Sir A. T. Dawson and G. T. Buckham, March 12th, 1914, No. 6312, on a portable and extensible observatory to be used for observation purposes by field artillery. In *the Engineer*, London, Mar. 26, 1915, v. CXIX, p. 320. T1.E48. v. 1181.
- Projectiles.*—Brief data concerning a universal shell patented by the Skoda Works, Austria, *Illustr. Zeitschrift. . . Schiess & Sprengstoffwesen*, Aug. 1, 1914, p. 299, No. 15.
- Reconnaissance, aerial.*—Attack and defense against hostile aircraft by artillery in the field. By Lieut. Col. H. de T. Phillips. Reconnaissance work by aircraft and artillery firing against, including a diagram. (In *Journal of the Royal Artillery*. Feb., 1915, pp. 733-738. UF2.J5, v. 41.)
- Reconnaissance, aerial—European war.*—The European war from an engineer's standpoint. By John B. C. Kershaw. An illustrated article describing and showing various types of aircraft, their possibilities, their use in directing the fire of the artillery, and their reconnaissance work. (In *the Engineering Magazine*, v. 48, January, 1915, pp. 498-507. TA1.E59.)
- Resistance to projectiles.*—Tests of armor and projectiles. A short article with illustrations showing a 12-inch armouring piercing shell after having passed through 12-inches of Krupp steel, and effect of 8-inch shells fired upon armoured steel ammunition tubes. (In *Scientific American*. v. 112. March 6, 1915, p. 214, TA1.S5.)
- Siege guns—Japan.*—Efficiency test of Ogata's heavy gun. (Japan.) It has been decided to use the German defense works at Tsingtao for the experimental test firing of heavy artillery. (In translation No. 2847, par. 67.)
- Siege warfare.*—Rôle of siege and field artillery during the operations round Adrianople. Brief translation of article in *Militar Wochenblatt*. *The Journal of the Royal Artillery*, January, 1915, p. 720.
- Transportation—guns.*—Precis of *Revue d'artillerie* for June and July, 1914. By Col. A. H. C. Phillpotts. Description of different methods of providing the wheels of heavy artillery with girdles for enabling it to travel over soft ground without sinking into the roadway. The cooperation between artillery and infantry. (In *Journal of the Royal Artillery*, London, Feb., 1915, pp. 788-790, UF2.J5, v. 41.)
- Transportation—guns.*—Man harness. (A suggestion.) By Captain M. Crofton. A light harness is suggested for artillerymen to be employed in dragging a gun where it is impracticable to use horses. (In *the Journal of the Royal Artillery*, London, Nov., 1914, pp. 541-542, UF2.J5, v. 41.)
- Turpinite—France.*—The French army bulletin of April 5, 1915, made the first official mention of the new explosive, turpinite, which has been discussed more or less vaguely for several months. A short paragraph on the use and effects. A new field piece is being manufactured in which turpinite may be used in the projectile. (In *Army and Navy Journal*, v. 52, Apr. 10, 1915, p. 1,000. U1.U7.)

BOOK REVIEWS

Pan-Americanism, by Roland G. Usher, New York, The Century Company. 1 vol. 8vo. Price \$2.00.

Mr. Usher's *Pan-Americanism* is a voluminous but deeply interesting exposition of the position in which the United States now finds itself, or rather the position in which the country will be found at the close of the great European war. Mr. Usher makes it uncomfortably clear to the "man in the street" that the splendid isolation and consequent freedom from the cares of jealously guarded trade and territorial rights which we once possessed are ours no longer. He presents a very convincing argument to prove that our interest in the European struggle is not that of the spectator. He makes us believe that our interest may well be that of the probable participant. Mr. Usher reminds us that our immunity from molestation and the apparent complaisance of the great European powers in regard to the Monroe Doctrine has depended in the past not upon our power to defend ourselves, nor upon the unwillingness of Europe to transgress the rights we have claimed in America, but solely upon the neat balance of power in Europe.

This balance of power has at last been upset; and Mr. Usher maintains that the hour has come for us to decide the questions which will inevitably be presented to us at the close of the war. Growth of trade and of population, together with an increasing demand for luxuries, all involve an expansion into new territory. The victor in the European struggle will turn to South America which has been practically rediscovered in the last fifty years.

The title of *Pan-Americanism* would seem to suggest a peaceful and mutually profitable confederation of South America and the United States. But Mr. Usher declares such a confederation to be an impossibility on account of dissimilarity of race, color, religion and interest. He adds further that South Americans would regard as a misfortune the enforcement of the Monroe Doctrine to the exclusion of Europeans, and that their sympathies would be with the victor in the European war should that victor threaten the supremacy of the United States in South American affairs. The interests of the South American countries are identical with those of the European powers. They are close to the Latin countries of Europe in race, religion and language. They regard Europe as the source of their education and wealth and pre-eminently as a model to be followed. So much for the question of a common sentiment.

As for a common benefit through trade, Mr. Usher assures us that it does not exist. Even though such a common benefit were to be created, he asks us if any nation would fight to defend its source of trade alone. He answers his own question with the quotation from Edward Everett Hale, "No one ever heard of a man shouldering his musket to defend his boarding house." To crowd Pelion on Ossa he closes the chapter on "Fallacies of Pan-Americanism" with these words, "If there is any such thing in this

world as isolation, separation, divergence we are isolated from Latin-America by the fundamental, impenetrable barriers of race, language and religion, laws, customs and tradition. Powerful agencies operating with great force and persistence will be needed to create and preserve any relationship between the American republics in the face of these obstacles. Not only are the premises of Pan-Americanism fallacies, their very antitheses are realities."

Mr. Usher discusses armament and disarmament, the necessity of defending ourselves and the beauty of peace, both as a benefit to ourselves and as an example to others, but he omits conclusions. Presenting the case as he sees it difficult of solution but nevertheless urgent, he leaves it for each reader to decide for himself.

F. MACD. B.

The American Army, By Maj.-Gen. William Harding Carter, Published by the Bobbs Merrill Publishing Co., Indianapolis. 1 vol. 8 vo.

Like nearly every other recent writer upon the subject of our military policy, Gen. Carter has based his conclusions upon the wisdom of George Washington as expressed in his letters to Congress and other State papers and upon the "The Military Policy of the United States," by Gen. Upton. But in a very happy and vigorous fashion he has also succeeded in portraying the exact military weakness of our country in such a way that even the most indifferent reader cannot fail to be impressed with the fact that, as a nation, we have never had a definite military policy and have never taken any adequate steps to turn military resources into military strength. Gen. Carter finds the genesis of this lack of sustained policy in the general incompatibility which he believes exists between military strength and a republican form of government. His book was written before the opening of the present European war or he might have seen fit to modify his statement in the light of the military strength which has been developed in France in spite of republicanism.

Unless we admit that patriotism is an obsolete impulse, Gen. Carter makes it very clear that we must at once begin to adopt some policy which will develop our latent military resources. He very correctly maintains that no force which is not truly national can adequately provide for national defense. For this reason he advocates the nationalization of all existing State forces.

He discusses the latent weakness of the War Department very frankly and from the point of view of one who has been intimately associated with it for many years. He points out the folly of our present centralized control and the unjustifiable way in which matters not even remotely military are assigned by Congress to the jurisdiction of the War Department to the prejudice of its purely military activities.

General Carter's suggestions as to a desirable organization for the Regular Army are not entirely consistent. As far as field artillery is concerned, he advocates in one place an increase in field artillery, the creation of depot battalions and a means for handling siege artillery without employing the coast artillery. In another he submits a table of organization for the Regular

Army which reduces the proportion of field guns to the ridiculous figure of 1.4 guns per 1,000 rifles.

The comments on training the corps of officers and the very important question of reserves and regimental depots are clear and concise.

At a time when so much general interest in military matters exists, Gen. Carter's book should prove of the greatest value to any one in search of a brief, accurate and readable exposition of our military weakness and an outline of one method of turning this weakness into strength.

Virginia Military Institute Military History, by Jennings C. Wise, Published by J. B. Bell, Co., Inc., Lynchburg, Va.

This book is of special interest at this time when there is general discussion of schemes for adequate national defense, because it is the record of what the graduates of a school closely modeled after the United States Military Academy accomplished during both the Mexican and Civil Wars.

It therefore points a way to create a body of men capable of becoming officers in time of war.

The creation of an army from untrained men is tremendously simplified if their officers have had thorough military training. From the day of its foundation in 1839 up to the present moment this institution has been a school of arms of the first order even when gauged by the standards of West Point. Its traditions and *esprit* are of the highest.

Prior to 1861 almost all its graduates had taken up peaceful pursuits, but they were immediately available for officers with the Confederate armies upon the outbreak of the war. How well they acquitted themselves is recorded in this book. To note one striking instance—all of the fifteen regimental commanders of Pickett's division at Gettysburg with the exception of two, were graduates of the Virginia Military Institute, and Pickett's division stands today both in history and romance as the flower of the Army of Northern Virginia.

The author, who has borne a commission in the Regular Army, describes with the knowledge of the professional soldier the military operations contained in the book. It gives a most comprehensive and accurate account of the Battle of Newmarket, Va., in which the Corps of Cadets (boys not averaging over eighteen years of age) bore a most conspicuous part and by their conduct afforded another of the many examples of the value of highly trained and disciplined troops.

The book contains many anecdotes of men whose names are written large in the history of the Civil War, anecdotes which are most interesting side lights upon their characters both before and after their deeds had made them famous.

Elements of Military Hygiene, by Maj. Percy M. Ashburn, Medical Corps, United States Army. Boston, Houghton Mifflin Co., 1 vol. 8vo. Price \$1.50 net.

This is a comprehensive and concisely written volume of 351 pages, and shows evidence of careful and systematic preparation, and on the whole is

an excellent compend for the line officer and the enlisted man on the subject of military hygiene. The author states in the preface that the book is written in the hope that it may both inform and interest the line officer and enlisted man in the subject of sanitation, and thus gain for the medical officer the sympathy and cooperation that he always needs but now too seldom has.

The volume consists of four parts—first, the recruit and his environment; second, the causes of disease; third, the prevention and control of epidemics; and lastly, the prevention of mental and nervous diseases. Under the subject of the recruit and his environment the author dwells quite extensively on the subject of recruiting; second, personal hygiene; third, foods and their preparation; fourth, hygiene of the barracks; fifth, camps; sixth, hygiene of moving troops; and seventh, the hygiene of hot and cold climates.

In the second part are included—first, the remote or predisposing causes of disease; second, the immediate or exciting causes of disease; third, disease carriers.

An important section is that which treats of the defenses against disease in general; Diseases due to infection through the alimentary tract, diseases due to infection through the respiratory tract, insect-borne diseases, and lastly, venereal diseases.

The fourth part is devoted to those nervous and mental diseases which are common in our Army.

The book is written in simple language, and its subjects are treated in such a manner as to be thoroughly understood by any intelligent reader.

EXCHANGES

Loaned to Members on Request.

Archives Militaires, Paris, France.
Arms and The Man, Washington, D. C.
Army and Navy Journal, New York City.
Army and Navy Register, Washington, D. C.
Artilleristische Monatshefte, Berlin, Germany.
Cavalry Journal, Fort Leavenworth, Kansas.
Circular Militar Argentio, Buenos Aires, Argentine Republic.
Dansk Artileri-Tidsskrift, Copenhagen, Denmark.
Flight, London, England.
Infantry Journal, Washington, D. C.
Journal des Sciences Militaires, Paris, France.
Journal of the Military Service Institution, Governor's Island.
Journal of the Royal Artillery, Woolwich, England.
Journal of the U. S. Artillery, Fort Monroe, Virginia.
Memorial de Artilleria, Madrid, Spain.
Memorial del Estado Mayor Jeneral, Santiago, Chile.
Militar Wochenblatt, Berlin, Germany.
National Guard Magazine.
New York Sun.
New York Tribune.
Norsk Artileritidsskrift, Kristiania, Norway.
Our Dumb Animals, Boston, Massachusetts.
Professional Memoirs, Corps of Engineers, Washington, D. C.
Revista de Artilharia, Lisbon, Portugal.
Revista di Artigleria e Genio, Rome, Italy.
Revista Militar, Buenos Aires, Argentine Republic.
Revue d'Artillerie, Paris, France.
Revue d'Infanterie, Paris, France.

Field Artillery Directory

REGULAR ARMY

| Name. | Batteries. | Name. | Batteries. |
|---|------------------|---|------------------|
| FIRST FIELD ARTILLERY. (Light.) | | <i>Second Lieutenants—Continued</i> | |
| Schofield Barracks, H. T. | | Winton, Walter F | B |
| <i>Colonel.</i> | | 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>Captains.</i> | | Lassiter, William | |
| Cassels, Arthur F | Adjt. | <i>Majors.</i> | |
| Hopkins, Frank E | Qm | Snow, William J | 1 Batt. |
| Williams, Harry C | E | Horn, Tiemann N | 2 Batt. |
| Apple, George M | F | | |
| Mason, Roger O | C | <i>Chaplain.</i> | |
| Browning, William S | A | Houlihan, James F. (1 lieu.) | |
| Ennis, William P | Unass'd | <i>Captains.</i> | |
| Frankenberger, Samuel | Unass'd | Granger, Ralph S | F |
| Ferris, Charles J | D | Stuart, Edward A | B |
| Rehkofer, Ned B | Adjt. | Birnie, Upton, Jr. | E |
| Glassford, Pelham D | 2 Batt. | Warfield, Augustus B | Comy. |
| <i>First Lieutenants.</i> | B | Barnes, Joseph F | C |
| Neal, Carroll W | E | Hollyday, Thomas W | Adjt. |
| McKinlay, Louis H | A | | 2 Batt |
| Dodds, William H., Jr. | C | Mortimer, Charles G | A |
| Huntley, Harold W | C | Wood, William S | D |
| Lyerly, Ballard | D | Allen, Charles M | Qm. |
| Potter, Waldo C | A | Morrison, William F | Adjt. |
| Pfeil, Harry | Unass'd | Allin, George R | Adjt. |
| Naylor, Harold S | F | | 1 Batt. |
| Marr, Harold E | B | <i>First Lieutenants.</i> | |
| McCleave, William | D | Blakely, Charles S | A |
| Martin, Truby C | E | Cubbison, Donald C | B |
| Rogers, Wilbur | F | Riley, James W | C |
| Palmer, Albert K. C | Unass'd | Parker, Cortlandt | E |
| <i>Second Lieutenants.</i> | | Lewis, Robert H | F |
| Gay, George S | Qm. and comy. | Booker, Philip W | F |
| | 1 Batt. | Pritchett, Edwin E | D |
| Selleck, Clyde A | Unass'd | Rucker, William H | E |
| Beard, Louie A | B | Shepherd, William H | B |
| Jones, Ivens | A | Dunn, William E | A |
| Goetz, Robert C. F | Unass'd | Gottschalk, Telesphor G | Qm. and comy. |
| Peyton, Bernard R | F | | 1 Batt. |
| Bowley, Freeman W | E | Rumbough, Joseph W | D |
| Hatch, John E | Unass'd | Brabson, Joe R | Qm. and comy. |
| Andrews, Joseph | D | | 2 Batt. |
| Deshon, Percy | F | <i>Second Lieutenants.</i> | |
| Maxwell, Russell L | Qm. and comy. | Wallace, Fred C | B |
| | 2 Batt. | Dawley, Ernest J | E |

FIELD ARTILLERY DIRECTORY—Continued

| Name. | Batteries. | Name. | Batteries. |
|---|------------------|---|--------------------------|
| <i>Second Lieutenants—Continued.</i> | | <i>Second Lieutenants.</i> | |
| Magruder, John | C | Greble, Edwin St. J., Jr | Qm. and comy. 2 Batt. |
| Riggs, E. Francis | D | | |
| Nance, Curtis H. | A | Bateman, Harold H. | A |
| Beatty, John C. | E | Odell, Herbert R. | B |
| Proctor, Mert | Unass'd | Simpson, Bethel W. | F |
| Meyer, Vincent | C | Vanderveer, Harold C. | E |
| Wilson, Robert W. | A | Browne, Charles J. | B |
| Barnes, Julian F. | F | Parker, Edwin P., Jr. | D |
| Gillespie, James A. | D | Eager, John M. | F |
| Clarkson, Herbert S. | B | Brewer, Carlos | A |
| Helmick, Charles G. | F | Cain, David E. | C |
| | | McMahon, John E., Jr. | C |
| | | Thurber, Philip L. | D |
| <i>Veterinarians.</i> | | <i>Veterinarians.</i> | |
| Mitchell, Aquila | | 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. | | Irwin, Geo. LeR. | |
| <i>Majors.</i> | | <i>Majors.</i> | |
| Lyon, Leroy S. | 1 Batt. | Gately, George G. | 2 Batt. |
| McCloskey, Manus | 2 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. | B |
| Farrar, Henry B. | Unass'd | Spaulding, Oliver L., Jr. | F |
| Austin, Fred T. | Adjt. | Faulkner, Albert U. | Unass'd |
| Donnelly, Edward T. | F | Langdon, Jesse G. | C |
| Jones, Clarence N. | E | Craig, Daniel F. | A |
| Bunker, Charles M. | Adjt. 1 Batt. | Lawson, Laurin L. | Adjt. |
| Hennessy, Frederick B. | Unass'd | Brewster, Alden F. | Qm. |
| Locke, Morris E. | D | Kilbourne, Henry S., Jr. | D |
| Michel, William N. | C | McNair, Lesley J. | Unass'd |
| Myers, Joseph E. | B | | |
| <i>First Lieutenants.</i> | | <i>First Lieutenants.</i> | |
| Honeycutt, Francis W. | D | Quinn, Leo P. | Qm. and comy. 2 Batt. |
| Hammond, John S. | B | | |
| Smith, Edwin De L. | B | Prosser, Walter E. | A |
| Burleson, Richard C. | D | Collins, Leroy P. | F |
| Olmstead, Dawson | F | Harlow, Charles W. | B |
| Paine, George H. | E | Mort, John E. | C |
| Downer, John W. | Unass'd | Barrows, Frederick M. | B |
| Parrott, Roger S. | A | Burns, James H. | C |
| Kirkwood, Robert G. | Unass'd | McBride, Allan C. | Qm. and comy. 1 Batt. |
| Dougherty, Louis R. | A | | |
| Hopkins, Samuel R. | F | Sparks, Leonard C. | D |
| Daly, Charles D. | C | Hollingsworth, Charles P. | E |
| | | Stewart, Frederick W. | E |
| | | Hayden, Herbert | D |

FIELD ARTILLERY DIRECTORY—Continued

| Name. | Batteries. | Name. | Batteries. |
|---|------------|--|---------------|
| <i>Second Lieutenants.</i> | | <i>Second Lieutenants—Continued.</i> | |
| Erlenkotter, Herman | Unass'd | Oliphant, Thomas G. M. | Qm. and comy. |
| Devers, Jacob L. | Unass'd | | 1 Batt. |
| Hobbs, Harvey M. | Unass'd | Bloom, Frank | F |
| Wrona, William J. | A | Jones, Lloyd E. | E |
| Thomason, Alfred G. | A | Polk, Newton N. | C |
| Morrow, Norman P. | B | Hauser, John N. | A |
| Andrus, Clift. | F | Greenwald, Karl C. | B |
| Anderson, Richard E. | B | Frankenberger, Bertram | E |
| Scott, Richard C. | C | Young, William C. | A |
| Eager, Howard. | D | Wyeth, John C. | D |
| Eikel, Joe | F | Burr, John G. | F |
| Harris, Arthur R. | E | Burr, William E. | C |
| <i>Veterinarians.</i> | | <i>Veterinarians.</i> | |
| Le May, Daniel. | | Jewell, Charles H. | |
| Power, Richard H. | | Sproule, William A. | |
| FIFTH FIELD ARTILLERY. (Light.) | | SIXTH FIELD ARTILLERY. (Horse.) | |
| Ft. Sill, Okla. | | Hdqrs. and Battys. A, B, and C, Douglas, Ariz. | |
| <i>Colonel.</i> | | Batty. D, Fort Riley, Kan. | |
| Adams, Granger | | Batty. E, Laredo, Tex. | |
| <i>Lieutenant Colonel.</i> | | Batty. F, Eagle Pass, Tex. | |
| McGlachlin, Edward F., Jr. | | <i>Colonel.</i> | |
| <i>Majors.</i> | | Greble, Edwin St. J. | |
| Bowley, Albert J. | Unass'd | <i>Lieutenant Colonel.</i> | |
| Bishop, Harry G. | Unass'd | Kenly, William L. | |
| <i>Chaplain.</i> | | <i>Major.</i> | |
| Sutherland, Alexander D. (1 lt.) | | Aultman, Dwight E. | 1 Batt. |
| <i>Captains.</i> | | Payne, Brooke. | 2 Batt. |
| Smith, Wright | E | <i>Chaplain.</i> | |
| Starbird, Alfred A. | Adj't. | Dickson, Thomas J. (maj.) | |
| Lanza, Conrad H. | Unass'd | <i>Captains.</i> | |
| Moore, Dan T. | Unass'd | Butner, Henry W. | D |
| Greene, George R. | Qm. | Scott, Ernest D. | Unass'd |
| Briggs, Raymond W. | D | Lloyd, Charles R. | Adj't. |
| Kilbreth, John W., Jr. | A | Boiseau, Louis T. | B |
| De Armond, Edward H. | Adj't. | Deems, Clarence, Jr. | E |
| Wood, Norton E. | 2 Batt. | Doyle, Fred C. | A |
| Baker, Scott | F | Campbell, Tilman | C |
| Hand, Daniel W. | B | Corey, John B. W. | F |
| <i>First Lieutenants.</i> | | Margetts, Nelson E. | Unass'd |
| Smith, Emery T. | C | <i>First Lieutenants.</i> | |
| Danford, Robert M. | Unass'd | Bishop, Albert T. | B |
| Gruber, Edmund L. | F | Starkey, John R. | A |
| Osborne, Thomas D. | Unass'd | Hoyle, Rene E. De R. | Unass'd |
| Pennell, Ralph McT. | D | Maul, John C. | A |
| Sturgill, Walter S. | E | Marley, James P. | C |
| Cruse, Fred T. | B | Merrill, Walter W. | B |
| Sharp, William F. | E | Tyndall, John G. | F |
| Thorp, Frank, Jr. | D | Sands, Alfred L. P. | D |
| Perkins, Kenneth S. | A | George, Charles P., Jr. | D |
| Crane, John A. | Unass'd | Randol, Marshall G. | E |
| Prince, Frederick A. | Unass'd | Higley, Harvey D. | E |
| <i>Second Lieutenants.</i> | | King, Edward P., Jr. | F |
| Seaman, George G. | Unass'd | Magruder, Marshall | C |
| Reynolds, Charles C. | D | | |

FIELD ARTILLERY DIRECTORY—Continued

| Name. | Batteries. | Name. | Batteries. |
|-------------------------------|------------|--------------------------------------|------------|
| <i>Second Lieutenants.</i> | | <i>Second Lieutenants—Continued.</i> | |
| Taliaferro, Lucien H..... | F | Crane, William C., Jr..... | E |
| Turner, Frank A..... | B | Sedlacek, Ernst..... | F |
| Finch, Neil G..... | C | Houghton, William C..... | C |
| Erwin, Vincent P..... | Unass'd | Anderson, John B..... | A |
| Hicks, Edward H..... | D | | |
| Anderson, Jonathan W..... | B | <i>Veterinarians.</i> | |
| Bailey, Wesley M..... | A | Hill, William P..... | |
| von Holtzendorff, John D..... | D | Stokes, Wilfred J..... | |
| 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 | 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, L. T.....25 jan. 07 | 6 |
| <i>Lieutenant Colonels.</i> | | | 21 | <i>Lambdin, W. McK</i>25 jan. | |
| 1 | McMahon, J. E.....3 may, 11 | 1 | 22 | Stuart, E. A.....25 jan. | 2 |
| 2 | Menoher, C. T.....26 may, | 3 | 23 | Donnelly, E. T.....25 jan. | 3 |
| 3 | <i>Hinds, E.</i>1 dec. | | 24 | Brooke, G. M.....25 jan. | |
| 4 | <i>March, P. C.</i>8 feb. 12 | | 25 | Williams, H. C.....25 jan. | 1 |
| 5 | Kenly, W. L.....26 aug. | 6 | 26 | Faulkner, A. U.....25 jan. | 4 |
| 6 | McGlachlin, E. F., jr.....27 dec. | 5 | 27 | Apple, G. M.....25 jan. | 1 |
| 7 | Lassiter, W.....16 mar. 13 | 2 | 28 | <i>Yule, E. H.</i>25 jan. | |
| 8 | Irwin, G. Le R.....18 nov. 14 | 4 | 29 | <i>Westervelt, W. I.</i>25 jan. | |
| <i>Majors.</i> | | | 30 | Birnie, U., jr.....25 jan. | 2 |
| 1 | <i>McNair, W. S.</i>15 nov. 10 | | 31 | Deems, C., jr.....25 jan. | 6 |
| 2 | Snow, W. J.....3 mar. 11 | 2 | 32 | Doyle, F. C.....25 jan. | 6 |
| 3 | Gatley, G. G.....11 mar. | 4 | 33 | Jones, C. N.....25 feb. 08 | 3 |
| 4 | Lyon, Le R. S.....11 mar. | 3 | 34 | <i>McIntyre, A.</i>25 jan. 07 | |
| 5 | Horn, T. N.....11 mar. | 2 | 35 | Greene, G. R.....25 jan. | 5 |
| 6 | <i>Summerall, C. P.</i>11 mar. | | 36 | Briggs, R. W.....25 jan. | 5 |
| 7 | Cruikshank, W. M.....11 mar. | 1 | 37 | Bunker, C. M.....25 jan. | 3 |
| 8 | <i>Farr, O. W. B.</i>13 apr. | | 38 | <i>Griffin, F. W.</i>25 jan. | |
| 9 | Aultman, D. E.....3 may, | 6 | 39 | <i>Welsh, R. S.</i>25 jan. | |
| 10 | <i>Fleming, A. S.</i>26 may, | | 40 | Campbell, T.....25 jan. | 6 |
| 11 | Payne, B.....7 sept. | 6 | 41 | Langdon, J. G.....25 jan. | 4 |
| 12 | Guignard, W. S.....1 dec. | 1 | 42 | Craig, D. F.....25 jan. | 4 |
| 13 | Bowley, A. J.....9 feb. 12 | 5 | 43 | Warfield, A. B.....25 jan. | 2 |
| 14 | Bishop, H. G.....26 aug. | 5 | 44 | <i>Burt, W. H.</i>12 june, | |
| 15 | <i>Newbill, W. D.</i>27 dec. | | 45 | Hennessy, F. B.....26 july, | 3 |
| 16 | McCloskey, M.....16 mar. 13 | 3 | 46 | Lawson, L. L.....12 aug. | 4 |
| 17 | McMaster, R. H.....18 nov. 14 | 4 | 47 | Locke, M. E.....25 aug. 08 | 3 |
| <i>Captains.</i> | | | 48 | Kilbreth, J. W., jr.....1 apr. 04 | 5 |
| 1 | Stephens, J. E.....23 sept. 01 | 3 | 49 | <i>Bryson, J. H.</i>10 sept. 09 | |
| 2 | Merrill, T. E.....23 sept. | 4 | 50 | Mason, R. O.....30 sept. | 1 |
| 3 | Conner, F.....23 sept. | | 51 | Browning, W. S.....15 nov. 10 | 1 |
| 4 | Butner, H. W.....23 sept. | 6 | 52 | Barnes, J. F.....3 mar. 11 | 2 |
| 5 | Newbold, H. L.....23 sept. | 4 | 53 | Ennis, W. P.....11 mar. | 1 |
| 6 | Scott, E. D.....23 sept. | 6 | 54 | <i>Currie, D. H.</i>11 mar. | |
| 7 | Smith, W.....20 sept. 02 | 5 | 55 | <i>Browne, B. F.</i>11 mar. | |
| 8 | Starbird, A. A.....31 july, 03 | 5 | 56 | <i>Pratt, R. S.</i>11 mar. | |
| 9 | Lloyd, C. R.....14 aug. | 6 | 57 | Brewster, A. F.....11 mar. | 4 |
| 10 | Spaulding, O. L., jr.....27 aug. | 4 | 58 | DeArmond, E. H.....11 mar. | 5 |
| 11 | Lanza, C. H.....1 nov. | 5 | 59 | Wood, N. E.....11 mar. 11 | 5 |
| 12 | Cassels, A. F.....23 nov. | 1 | 60 | <i>Fuger, A. S.</i>11 mar. | |
| 13 | Gallup, F. H.....7 july, 04 | 3 | 61 | Michel, W. N.....11 mar. | 3 |
| | | | 62 | <i>Wheeler, E. S.</i>11 mar. | |
| | | | 63 | Hollyday, T. W.....11 mar. | 2 |
| | | | 64 | Corey, J. B. W.....13 apr. | 6 |
| | | | 65 | <i>Churchill, M.</i>13 apr. | |
| | | | 66 | <i>Jones, W. F.</i>13 apr. | |
| | | | 67 | Mortimer, C. G.....26 may, | 2 |

(a) Additional in grade.

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> | | | | | |
| 68 | Margetts, N. E. 26 may, | 6 | 55 | Capron, W. A. 11 mar. | |
| 69 | Davis, R. 7 june, | | 56 | Mort, J. E. 11 mar. | 4 |
| 70 | Myers, J. E. 7 sept. | 3 | 57 | Barrows, F. M. 11 mar. | 4 |
| 71 | Wood, W. S. 8 sept. | 2 | 58 | Dunn, W. E. 11 mar. | 2 |
| 72 | Frankenberger, S. 18 oct. | 1 | 59 | Burns, J. H. 11 mar. | 4 |
| 73 | Allen, C. M. 1 dec. | 2 | 60 | Hughes, E. S. 11 mar. | |
| 74 | Morrison, W. F. 9 feb. 12 | 2 | 61 | Smith, T. J. 11 mar. | |
| 75 | Ferris, C. J. 26 aug. | 1 | 62 | Parrott, R. S. 11 mar. | 3 |
| 76 | Rehkopf, N. B. 11 july, 13 | 1 | 63 | Gottschalk, T. G. 11 mar. | 2 |
| 77 | Baker, S. 9 oct. | 5 | 64 | Higley, H. D. 11 mar. | 6 |
| 78 | Howse, M. W. 24 oct. | | 65 | King, E. P., jr. 13 apr. | 6 |
| 79 | Kilbourne, H. S., jr. 22 nov. | 4 | 66 | Perkins, K. S. 13 apr. | 5 |
| 80 | McNair, L. J. 19 apr. 14 | 4 | 67 | Kirkwood, R. G. 13 apr. | 3 |
| 81 | Allin, G. R. 13 june, | 2 | 68 | Marr, H. E. 26 may, | 1 |
| 82 | Glassford, P. D. 18 nov. | 1 | 69 | Rumbough, J. W. 7 june, | 2 |
| 83 | Bryden, W. 10 jan. 15 | | 70 | McCleave, W. 13 june, | 1 |
| 84 | Hand, D. W. 25 jan. 07 | 5 | 71 | McBride, A. C. 20 june, | 4 |
| <i>First Lieutenants.</i> | | | | | |
| | | | 72 | Brabson, J. R. 20 june, | 2 |
| | | | 73 | Sparks, L. C. 1 july, | 4 |
| | | | 74 | Crane, J. A. 1 july, | 5 |
| 1 | Honeycutt, F. W. 25 jan. 07 | 3 | 75 | Prince, F. A. 1 apr. 12 | 5 |
| 2 | Blakely, C. S. 25 jan. | 2 | 76 | Magruder, M. 28 may. | 6 |
| 3 | Smith, E. T. 25 jan. | 5 | 77 | Martin, T. C. 31 may. | 1 |
| 4 | Danford, R. M. 25 jan. | 5 | 78 | Rogers, W. 31 july, | 1 |
| 5 | Quinn, L. P. 25 jan. | 4 | 79 | Dougherty, L. R. 22 aug. | 3 |
| 6 | Gruber, E. L. 25 jan. | 5 | 80 | Hopkins, S. R. 26 aug. | 3 |
| 7 | Neal, C. W. 25 jan. | 1 | 81 | Hollingsworth, C. P. 6 sept. | 4 |
| 8 | Cubbison, D. C. 25 jan. | 2 | 82 | Daly, C. D. 5 mar. 13 | 3 |
| 9 | McKinlay, L. H. 25 jan. | 1 | 83 | Palmer, A. K. C. 22 Nov. | 1 |
| 10 | Osborne, T. D. 25 jan. | 5 | 84 | Stewart, F. W. 13 june, 14 | 4 |
| 11 | Seagrave, D. 25 jan. | | 85 | Hayden, H. 18 nov. | 4 |
| 12 | Dodds, W. H., jr. 25 jan. | 1 | 86 | Ahren, L. J. 10 jan. 15 | |
| 13 | Lund, J. 25 jan. | | 87 | Beere, D. M. 10 jan. | |
| 14 | Hammond, J. S. 25 jan. | 3 | <i>Second Lieutenants.</i> | | |
| 15 | Bishop, A. T. 25 jan. | 6 | 1 | Erlenkotter, H. 11 june, 09 | 4 |
| 16 | Prosser, W. E. 25 jan. | 4 | 2 | Thummel, C. B. 11 june, | |
| 17 | Riley, J. W. 25 jan. | 2 | 3 | Miner, H. E. 11 june, | |
| 18 | Huntley, H. W. 25 jan. | 1 | 4 | Greble, E. St. J., jr. 11 june, | 3 |
| 19 | Smith, E. De L. 25 jan. | 3 | 5 | Devers, J. L. 11 june, | 4 |
| 20 | Pennell, R. McT. 6 july, | 5 | 6 | Taliaferro, L. H. 14 july, | 6 |
| 21 | Sturgill, W. S. 7 july, | 5 | 7 | Bateman, H. H. 14 july, | 3 |
| 22 | Miles, S. 8 july, | | 8 | Turner, F. A. 13 nov. | 6 |
| 23 | Parker, C. 8 july, | 2 | 9 | Seaman, G. G. 13 nov. | 5 |
| 24 | Burleson, R. C. 9 july, | 3 | 10 | Reynolds, C. C. 13 nov. | 5 |
| 25 | Gilmor, A. 10 july, | | 11 | Gay, G. S. 18 jan. 10 | 1 |
| 26 | Starkey, J. R. 11 july, | 6 | 12 | Wallace, F. C. 15 june | 2 |
| 27 | Hoyle, R. E. DeR. 11 july, | 6 | 13 | Lewis, B. O. 15 june | |
| 28 | Olmstead, D. 12 july, | 3 | 14 | Odell, H. R. 15 june, | 3 |
| 29 | Maul, J. C. 12 july, | 6 | 15 | Selleck, C. A. 15 june, | 1 |
| 30 | Hall, A. L. 13 july, | | 16 | Dawley, E. J. 15 june, | 2 |
| 31 | Paine, G. H. 13 july, | 3 | 17 | Beard, L. A. 15 june, | 1 |
| 32 | Collins, L. P. 16 july, | 4 | 18 | Jones, I. 15 june, | 1 |
| 33 | Lyerly, B. 19 july, | 1 | 19 | Goetz, R. C. F. 17 aug. | 1 |
| 34 | Lewis, R. H. 26 july | 2 | 20 | Peyton, B. R. 8 sept. | 1 |
| 35 | Booker, P. W. 12 aug. | 2 | 21 | Magruder, J. 9 sept. | 2 |
| 36 | Pritchett, E. E. 5 mar. 08 | 2 | 22 | Riggs, E. F. 11 feb. 11 | 2 |
| 37 | Cruse, F. T. 1 july, | 5 | 23 | Nance, C. H. 13 june, | 2 |
| 38 | Marley, J. P. 20 july, | 6 | 24 | Bowley, F. W. 13 june, | 1 |
| 39 | Potter, W. C. 25 aug. | 1 | 25 | Beatty, J. C. 13 june, | 2 |
| 40 | Pfeil, H. 17 sept. | 1 | 26 | Hatch, J. E. 13 june, | 1 |
| 41 | Merrill, W. W. 16 june, 09 | 6 | 27 | Walker, C. A., jr. 13 june, | |
| 42 | Downer, J. W. 10 sept. | 3 | 28 | Simpson, B. W. 13 june, | 3 |
| 43 | Bailey, B. M. 29 sept. | | 29 | Finch, N. G. 13 june, | 6 |
| 44 | Sharp, W. F. 30 sept. | 5 | 30 | Hobbs, H. M. 14 june, | 4 |
| 45 | Thorp, F., jr. 14 jan. 10 | 5 | 31 | Andrews, J. 15 june, | 1 |
| 46 | Tyndall, J. G. 3 mar. 11 | 6 | 32 | Olipphant, T. G. M. 20 july, | 5 |
| 47 | Sands, A. L. P. 11 mar. | 6 | 33 | Proctor, M. 20 july, | 2 |
| 48 | George, C. P., jr. 11 mar. | 6 | 34 | Wrona, W. J. 20 july, | 4 |
| 49 | Harlow, C. W. 11 mar. | 4 | 35 | Erwin, V. P. 19 aug. | 6 |
| 50 | Naylor, H. S. 11 mar. | 1 | 36 | Bloom, F. 27 sept. | 5 |
| 51 | Rucker, W. H. 11 mar. | 2 | 37 | Meyer, V. 28 sept. | 2 |
| 52 | Shepherd, W. H. 11 mar. | 2 | 38 | Hicks, E. H. 28 sept. | 6 |
| 53 | Randol, M. G. 11 mar. | 6 | 39 | Thomason, A. G. 29 sept. | 4 |
| 54 | Greely, J. N. 11 mar. | | | | |

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> | | |
| 40 | Wilson, R. W. 6 oct. | 2 | 61 | Daly, J. O. 30 nov. | 1 |
| 41 | Morrow, N. P. 7 oct. | 4 | 62 | Parker, E. P., jr. 30 nov. | 3 |
| 42 | Jones, L. E. 7 oct. | 5 | 63 | Eager, J. M. 30 nov. | 3 |
| 43 | Polk, N. N. 7 oct. | 5 | 64 | Scott, R. C. 15 jan. 13 | 4 |
| 44 | <i>Bradley, F.</i> 2 dec. | | 65 | Eager, H. 25 mar. | 4 |
| 45 | Anderson, J. W. 3 dec. | 6 | 66 | Young, W. C. 12 june, | 5 |
| 46 | Deshon, P. 24 apr. 12 | 1 | 67 | Crane, W. C., jr. 12 june, | 6 |
| 47 | Barnes, J. F. 24 apr. | 2 | 68 | Brewer, C. 12 june, | 3 |
| 48 | Vanderveer, H. C. 24 apr. | 3 | 69 | Cain, D. E. 12 june, | 3 |
| 49 | Andrus, C. 24 apr. | 4 | 70 | McMahon, J. E., jr. 12 june, | 3 |
| 50 | Maxwell, R. L. 12 june, | 1 | 71 | Clarkson, H. S. 26 june, | 2 |
| 51 | Browne, C. J. 12 june, | 3 | 72 | Eikel, J. 14 july, | 4 |
| 52 | Hauser, J. N. 12 june, | 5 | 73 | Helmeck, C. G. 18 july, | 2 |
| 53 | Greenwald, K. C. 12 june, | 5 | 74 | Sedlacek, E. 30 aug. | 6 |
| 54 | Anderson, R. E. 12 june, | 4 | 75 | Thurber, P. L. 12 june, 14 | 3 |
| 55 | Gillespie, J. A. 12 june, | 2 | 76 | Houghton, W. C. 12 june, | 6 |
| 56 | Bailey, W. M. 12 june, | 6 | 77 | Wyeth, J. C. 12 june, | 5 |
| 57 | von Holtzendorff, J. D. 22 july, | 6 | 78 | Harris, A. R. 12 june, | 4 |
| 58 | Winton, W. F. 23 july, | 1 | 79 | Burr, J. G. 12 june, | 5 |
| 59 | Frankenberger, B. 30 nov. | 5 | 80 | Anderson, J. B. 12 june, | 6 |
| 60 | Austin, R. B. 30 nov. | 6 | 81 | Burr, W. E. 12 june, | 5 |

MILITIA

FIRST INSPECTION DISTRICT

Capt. Robert Davis, Inspector, Boston, Mass.

Massachusetts

FIRST BATTALION

Headquarters, Boston

Maj. J. H. Sherburne.

Capt. Henderson Inches, Battalion Adjutant.

1st. Lieut. F. H. Nesmith, Battalion Quartermaster and Commissary.

BATTERY A, BOSTON

Capt. Richard K. Hale.

1st Lieut. N. Wigglesworth.

1st Lieut. E. B. Richardson.

2nd Lieut. H. S. Allen.

2nd Lieut. R. C. Ware.

BATTERY B, WORCESTER

Capt. John F. J. Herbert.

1st Lieut. Walter J. Cookson.

1st. Lieut. Arthur P. Trombly.

2nd Lieut. George Bieberbock.

BATTERY C, LAWRENCE

Capt. T. D. Howe.

1st Lieut. George McLane, Jr.

1st Lieut. W. W. Roberts.

2nd Lieut. R. A. Daniels.

2nd Lieut. Sumner H. Needham.

Connecticut

BATTERY A, BRANFORD

Capt. Charles S. Yeomans.

2nd Lieut. John J. Ahern.

Rhode Island

BATTERY A, PROVIDENCE

Capt. Everitte S. Chaffee.

1st Lieut. Wm. Gammell, Jr.

1st Lieut. Daniel Howland.

2nd Lieut. Gerald T. Hanley.

2nd Lieut. Donald S. Babcock.

SECOND INSPECTION DISTRICT

Capt. D. W. Hand and Lieut. Harry Pfeil, Inspectors,
New York City

New Jersey

BATTERY A, EAST ORANGE

Capt. Claude E. Lanterman.

1st Lieut. Edward C. James.

1st Lieut. Henry Bennet.

2nd Lieut. W. F. Rothenburger.

2nd Lieut. C. A. Nordine.

BATTERY B, CAMDEN

Capt. Samuel G. Barnard.

1st Lieut. Charles M. Ferat, Jr.

1st Lieut. Samuel R. English.

2nd Lieut. Charles C. Dickinson.

2nd Lieut. John H. Dittess.

New York

FIRST FIELD ARTILLERY

Headquarters, New York City

Col. Henry H. Rogers.

Lieut. Col. Merritt H. Smith.

Capt. Dawson Olmstead, Adjutant (1st Lieut., U. S. A.).

Capt. Francis D. Browne, Quartermaster.

Capt. Alvin W. Perry, Commissary

Capt. Prentice Strong, Battalion Adjutant.

Capt. Leonard B. Smith, Battalion Adjutant.

It is requested that all errors be reported to the Editor.

FIELD ARTILLERY DIRECTORY—Continued

Veterinarian Eugene Combs.

BATTERY A, SYRACUSE

Capt. Guido F. Verbeck.
1st Lieut. George G. Bailey.
1st Lieut. Thomas E. Hitchcock.
2nd Lieut. William H. Thomas.
2nd Lieut. Edward R. Granger.

BATTERY B, NEW YORK CITY

Capt. Robert D. Mills.
1st Lieut. Louis D. Fancher.
2nd Lieut. Channing R. Toy.
2nd Lieut. Walter C. McClure.

BATTERY C, BINGHAMPTON

Capt. Chas. R. Seymour.
1st Lieut. Arthur S. Douglas.
1st Lieut. John T. Shinnars.
2nd Lieut. Chas. G. Blakeslee.
2nd Lieut. Arthur E. Kaepfel.

BATTERY D, NEW YORK CITY

Capt. James E. Austin.
1st Lieut. Benjamin Van Raden.
1st Lieut. Sylvester Simpson.
2nd Lieut. Frederick J. Koch.

BATTERY E, NEW YORK CITY

Capt. John T. Delaney.
1st Lieut. Frederick H. Ryan.
1st Lieut. Joseph H. de Rivera.
2nd Lieut. George B. Gibbons.

BATTERY F, NEW YORK CITY

Capt. Harold Lawson.
1st Lieut. Raymond M. Reid.
2nd Lieut. Frederick F. Moore.

SECOND FIELD ARTILLERY

Headquarters, Brooklyn

Col. George A. Wingate.
Lieut. Col. Frank H. Hines.
Maj. Chauncey Matlock.
Maj. Joseph I. Berry.
Capt. DeWitt C. Weld, Adjutant.
Capt. Louis F. Kuntz, Quartermaster.
Capt. Wilbur T. Wright, Commissary.
Capt. Wm. B. Short, Battalion Adjutant.
Capt. Eugene F. Lohr, Battalion Adjutant.
1st Lieut. Albert D. Washington, Battalion
Quartermaster and Commissary.
2nd Lieut. Herbert C. Dienst, Battalion Quartermaster
and Commissary.
Veterinarian Harry F. Nimphius.
Veterinarian Robt. A. McAuslin.

BATTERY A, BROOKLYN

Capt. Walter P. Fox.
1st Lieut. John D. Butt.
2nd Lieut. Roger P. Clark.

BATTERY B, BROOKLYN

Capt. Lester C. Fox.
1st Lieut. Horst A. C. Albrecht.
2nd Lieut. Harry C. Miller.

BATTERY C, BROOKLYN

Capt. Albert S. Hamilton.
1st Lieut. Thomas A. Buys.
1st Lieut. Eugene A. Holmes.
2nd Lieut. Walter H. Simonson.

BATTERY D, NEW YORK CITY

Capt. James B. Richardson.
1st Lieut. Howard E. Sullivan.
1st Lieut. Alphonse W. Weiner.
2nd Lieut. Charles J. McGronan.

BATTERY E, NEW YORK CITY

Capt. John J. Stephens, Jr.
1st Lieut. Francis T. Colby.
1st Lieut. Robert W. Marshall.

BATTERY F, NEW YORK CITY

Capt. William O. Richardson.
1st Lieut. Samuel E. McRickard.
1st Lieut. Charles H. King.
2nd Lieut. Frederick W. Bergstein.
2nd Lieut. Raymond L. Hoffman.

THIRD INSPECTION DISTRICT

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

District of Columbia

1ST BATTERY, WASHINGTON, D. C.

Capt. Louis C. Vogt.
1st Lieut. George G. Wilson.
1st Lieut. George A. Bonnet.
2nd Lieut. Harry E. Shilling.
2nd Lieut. Ellwood S. Moorhead.

Pennsylvania

BATTERY A, SOUTH BETHLEHEM

Capt. Thomas O. Cole.
1st Lieut. Elmer G. Tice.
1st Lieut. Carter L. Wright.
2nd Lieut. Ray R. Geary.
2nd Lieut. Herbert M. Paul.

BATTERY B, PITTSBURGH

Capt. William T. Rees.
1st Lieut. Clinton T. Bundy.
1st Lieut. John S. Purer.
2nd Lieut. Chas. C. Williams.
2nd Lieut. Chas. C. Benton.

BATTERY C, PHOENIXVILLE

Capt. Chas. H. Cox.
1st Lieut. Frederick S. Swier.
2nd Lieut. Augustine S. Janeway.
2nd Lieut. Samuel A. Whitaker.

BATTERY D, WILLIAMSPORT

Capt. William B. Reilly.
1st Lieut. John D. Andrews.
2nd Lieut. John H. Ball.
2nd Lieut. Clyde R. Shelley.

It is requested that all errors be reported to the Editor.

FIELD ARTILLERY DIRECTORY—Continued

Virginia

FIRST BATTALION

Headquarters, Richmond

Major Thomas M. Wortham.
 Capt. William W. LaPrade, Adjutant.
 1st Lieut. Edward S. Shields, Quartermaster.

BATTERY A, RICHMOND

Capt. William M. Myers.
 1st Lieut. Edward C. Rees.
 1st Lieut. James C. Pollard.
 2nd Lieut. John T. Wood.
 2nd Lieut. George H. Myers.

BATTERY B, NORFOLK

Capt. Robert C. Lehman.
 1st Lieut. Lee F. Lawler.
 1st Lieut. P. W. Kear.
 2nd Lieut. McChesney H. Jeffres.
 2nd Lieut. Edmond L. Sylvester.

BATTERY C, PORTSMOUTH

Capt. Robert B. MacDonald.
 1st Lieut. Walter J. Tennent.
 2nd Lieut. Ralph O. Oliver

FOURTH INSPECTION DISTRICT

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

Alabama

FIRST BATTALION

Headquarters, Birmingham

Maj. Leon. S. Dorrance.
 Capt. Hartley A. Moon, Adjutant.
 1st Lieut. J. Alt. Luckie, Quartermaster and
 Commissary.

BATTERY A, BIRMINGHAM

Capt. Frank Flinn.
 1st Lieut. Walter L. Furman.
 2nd Lieut. Robert L. Pittman.

BATTERY C, BIRMINGHAM

Capt. Edward L. Anderson.
 1st Lieut. William S. Pritchard.
 1st Lieut. Julian P. Smith.

Georgia

FIRST BATTALION

Headquarters, Savannah

Maj. Richard J. Davant.
 Capt. William M. Douglas, Adjutant.

BATTERY A, SAVANNAH

Capt. Edward G. Thomson.
 1st Lieut. Edward G. Butler.
 1st Lieut. Valentine Seyden.
 2nd Lieut. Alexander R. MacDonell.
 2nd Lieut. Mathias M. Ray.

BATTERY B, ATLANTA

Capt. Andrew J. McBride, Jr.
 1st Lieut. Robert G. Mangum.
 1st Lieut. Leonard F. Wilson.

BATTERY C, SAVANNAH

Capt. Edward D. Wells.
 1st Lieut. Joseph H. Thompson.
 1st Lieut. Charles G. Lang.
 2nd Lieut. Cecil Cheves.

Louisiana

FIRST BATTALION

Headquarters, New Orleans

Maj. Allison Owen.
 Capt. Bryan Black, Adjutant.
 1st Lieut. Joseph C. Sanders, Quartermaster and
 Commissary.

BATTERY A, NEW ORLEANS

1st Lieut. Stanley M. Lemarie.
 2nd Lieut. William K. Nourse.

BATTERY B, NEW ORLEANS

1st Lieut. James E. Edmonds.
 1st Lieut. Edwin M. Kursheedt.
 2nd Lieut. Prentiss M. Johnson.
 2nd Lieut. Harold P. Nathan.

BATTERY C, NEW ORLEANS

1st Lieut. Gabriel S. Adams.

FIFTH INSPECTION DISTRICT

Capt. Clarence Deems, Inspector, Indianapolis, Indiana

Indiana

FIRST BATTALION

Headquarters, Indianapolis

Major Robert H. Tyndall.

BATTERY A, INDIANAPOLIS

Capt. Gavin L. Payne.
 1st Lieut. Frank W. Bushmann.
 2nd Lieut. Chas. L. Watson.
 2nd Lieut. Solon J. Carter.

BATTERY B, PURDUE UNIVERSITY, LAFAYETTE

Capt. Harry E. McIvor.
 1st Lieut. Harris C. Mahin.
 1st Lieut. Frank D. Dexter.
 2nd Lieut. Allan D. Philips.
 2nd Lieut. Joseph J. Johnston.

BATTERY C, LAFAYETTE

Capt. Thomas S. Wilson.
 1st Lieut. Joseph A. Andrew.
 1st Lieut. Rosier W. Levering.
 2nd Lieut. John C. Doyle.
 2nd Lieut. Frank Nisley.

It is requested that all errors be reported to the Editor.

FIELD ARTILLERY DIRECTORY—Continued

Michigan

BATTERY A, LANSING

Capt. Chester B. McCormick.
1st Lieut. Amos H. Ashley.
1st Lieut. Fred G. Fuller.
2nd Lieut. F. G. Chaddock.
2nd Lieut. Earl H. Spencer.

BATTERY B, LANSING

Capt. Donald M. Childs.
1st Lieut. Frank P. Dunnebacke.
2nd Lieut. Chester E. Boelio.
2nd Lieut. Joseph H. Lewis.

Ohio

FIRST BATTALION

Headquarters, Briggsdale

Maj. H. M. Bush.
Capt. Carl H. Hirstius, Adjutant.
2nd Lieut. John B. Morton, Battalion Quartermaster and Commissary.

BATTERY A, CLEVELAND

Capt. Quida A. Kulish.
1st Lieut. Fred T. Mudge.
1st Lieut. Everete C. Williams.

BATTERY B, MT. VERNON

Capt. Paul L. Jensen.
2nd Lieut. Robert D. Dowds.
2nd Lieut. Vincent B. Welker.
Veterinarian, Frank R. Lunn.

BATTERY C, BRIGGSDALE (COLUMBUS)

Capt. Rodney E. Pierce.
2nd Lieut. George H. Bartholomew.
2nd Lieut. Lawrence S. Schlegel.

SIXTH INSPECTION DISTRICT

Lieut. Louis R. Dougherty, Inspector, Chicago, Illinois

Illinois

FIRST BATTALION

Headquarters, Waukegan

Maj. Ashbel V. Smith.
Capt. George H. Gould, Adjutant.
1st Lieut. Curtis G. Redden, Quartermaster and Commissary.

BATTERY A, DANVILLE

Capt. Orvil F. Hopper.
1st Lieut. Fred J. Starkey.
1st Lieut. Leslie P. Livengood.
2nd Lieut. Fred G. Anderson.
2nd Lieut. John D. Cole.

BATTERY B, CHICAGO

Capt. Frank M. Course.
1st Lieut. Max. E. Payne.
1st Lieut. J. B. Weintraub.
2nd Lieut. James P. Tyrell.

BATTERY C, WAUKEGAN

1st Lieut. Joseph R. Durkin.
1st Lieut. Fred C. Morey.
2nd Lieut. Philo J. Burgess.
2nd Lieut. Edward E. Barclay.
2nd Lieut. Albert C. Ofenlock.

Wisconsin

BATTERY A, MILWAUKEE

Capt. Philip C. Westfahl.
1st Lieut. Alonzo J. Comstock.
1st Lieut. John G. Reed.
2nd Lieut. William F. Fraedrich.
2nd Lieut. Alvin A. Knechenmeister.

Iowa

BATTERY A, CLINTON

Capt. George W. Dulany, Jr.
1st Lieut. James L. Oakes.
1st Lieut. Eugene J. Curtis.
2nd Lieut. Martin Purcell.
2nd Lieut. Charles M. Frahm.

SEVENTH INSPECTION DISTRICT

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

Kansas

BATTERY A, TOPEKA

Capt. Clarence G. Grimes.
1st Lieut. Martin C. Pennekamp.
1st Lieut. Dana T. Jennings.
2nd Lieut. Frank E. Barnard.
2nd Lieut. Charles E. Edwards.

Missouri

FIRST BATTALION

BATTERY A, ST. LOUIS

Capt. Frank M. Rumbold.
1st Lieut. Walter J. Warner.
1st Lieut. Robert C. Rutledge.
2nd Lieut. Edwin R. Nieheus.
2nd Lieut. Daniel F. Jones.

BATTERY B, KANSAS CITY

Capt. Arthur J. Elliott.
1st Lieut. Roy T. Olney.
1st Lieut. Fielding L. D. Carr.
2nd Lieut. Harry W. Ruttlinger.
2nd Lieut. Herman H. Kube.

BATTERY C, INDEPENDENCE

Capt. Edward M. Stayton.
1st Lieut. John L. Miles.
1st Lieut. Spencer Salisbury.
2nd Lieut. Harry B. Allen.
2nd Lieut. George W. Cassell.

Texas

BATTERY A, DALLAS

Capt. F. A. Logan.
1st Lieut. Sanford A. Stewart, Jr.
1st Lieut. Fred M. Logan.
2nd Lieut. Ward C. Goessling.

It is requested that all errors be reported to the Editor.

FIELD ARTILLERY DIRECTORY—Continued

EIGHTH INSPECTION DISTRICT

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

Colorado

BATTERY A, DENVER

Capt. John B. Goodman, Jr.
 1st Lieut. John P. Donovan.
 1st Lieut. Edwin F. Carson.
 2nd Lieut. William H. Schade.
 2nd Lieut. Harry O. Nichols.

BATTERY B, DENVER

Capt. B. M. Lake.
 1st Lieut. Ittia A. Elliott.
 2nd Lieut. Earl L. Edwards.

New Mexico

BATTERY A, ROSWELL

Capt. Charles M. de Bremond.
 1st Lieut. James C. Hamilton.
 1st Lieut. Willard F. Hird.
 2nd Lieut. George M. Williams.

Utah

1ST BATTERY, SALT LAKE CITY

Capt. William C. Webb.
 1st Lieut. Curtis Y. Clawson.
 1st Lieut. Alex R. Thomas.
 2nd Lieut. Fred T. Gundry.
 2nd Lieut. Paul W. Billings.

NINTH INSPECTION DISTRICT

Capt. E. H. Yule, Inspector, San Francisco, Cal.

California

FIRST BATTALION

Headquarters, Oakland

Maj. Ralph J. Faneuf.
 Capt. Frederick W. H. Peterson, Adjutant.
 1st Lieut. John S. Riley, Quartermaster and
 Commissary.

BATTERY A, LOS ANGELES

1st Lieut. Jesse McComas.
 1st Lieut. Samuel C. Haver, Jr.
 2nd Lieut. Harry L. Powell, Jr.
 2nd Lieut. Plummer H. Montgomery.

BATTERY B, OAKLAND

Capt. Harry F. Huber.
 1st Lieut. Edward E. Vicary.
 2nd Lieut. John W. White.
 2nd Lieut. Howard W. Enefer.

BATTERY C, STOCKTON

Capt. Edward Van Vranken.
 1st Lieut. Otto E. Sandman.
 1st Lieut. Asa M. Clark.
 2nd Lieut. Charles H. Young.
 2nd Lieut. Hunt A. Davidson.

Oregon

BATTERY A, PORTLAND

1st Lieut. George B. Otterstedt.
 1st Lieut. Bert V. Clayton.
 2nd Lieut. Charles L. Johnson.
 2nd Lieut. Arthur H. Friese.

STATE OF MINNESOTA

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

FIRST FIELD ARTILLERY

Headquarters, St. Paul

Col. George C. Lambert.
 Lieut. Col. William J. Murphy.
 Maj. Gates A. Johnson, Jr., First Battalion.
 Maj. George E. Leach, Second Battalion.
 Capt. Charles A. Green, Adjutant.
 Capt. Fred L. Baker, Quartermaster.
 Capt. William H. Donahue, Commissary.
 Capt. Harry M. Boyer, Battalion Adjutant.
 1st Lieut. John H. Schoonmaker, Battalion
 Quartermaster and Commissary.
 2nd Lieut. James K. Scott, Jr., Battalion Quartermaster
 and Commissary, First Battalion.

BATTERY A, ST. PAUL

Capt. Arthur G. Teuchert.
 1st Lieut. John Hammerbacher.
 1st Lieut. Henry A. Stempel.
 2nd Lieut. Otto K. Seidel.
 2nd Lieut. Charles Weiss.

BATTERY B, ST. PAUL

Capt. Frederick A. Tiffany.
 1st Lieut. Theodore A. Kaldunski.
 2nd Lieut. Chester W. Gaskell.
 2nd Lieut. Horace S. Sorrells.

BATTERY C, ST. PAUL

Capt. Thomas J. O'Leary.
 1st Lieut. John H. McDonald.
 1st Lieut. Roger J. Finn.
 2nd Lieut. Philip J. McCauley.

BATTERY D, MINNEAPOLIS

Capt. George T. Gorman.
 1st Lieut. Douglas G. Burrill.
 1st Lieut. William J. Gilmour.
 2nd Lieut. Julius H. Pohlson.

BATTERY E, MINNEAPOLIS

Capt. J. Edwin Jensen.
 1st Lieut. Louis Baker.
 1st Lieut. Jerome Jackman.
 2nd Lieut. William R. Cross.
 2nd Lieut. Thomas A. Hillary.

BATTERY F, MINNEAPOLIS

Capt. Walter F. Rhinow.
 1st Lieut. John J. Tanffe.
 1st Lieut. Fletcher Rockwood.
 2nd Lieut. William H. Kennedy.
 2nd Lieut. Edwin Rollmann.

UNASSIGNED*New Hampshire*

BATTERY A, MANCHESTER

Capt. Edwin L. Towle.
 1st Lieut. Frank J. Abbott.
 1st Lieut. Henry A. Worthen.
 2nd Lieut. Lucius E. Hill.
 2nd Lieut. George W. Upton.

It is requested that all errors be reported to the Editor.

ACTIVE MEMBERSHIP, FIELD ARTILLERY ASSOCIATION.

Regular Army.

| | |
|-------------------------------|---------------|
| 5th Field Artillery | 100 per cent. |
| Unassigned to regiments | 92 per cent. |
| 3rd Field Artillery | 90 per cent. |
| 6th Field Artillery | 87 per cent. |
| 4th Field Artillery | 82 per cent. |
| 1st Field Artillery | 80 per cent. |
| 2nd Field Artillery | 78 per cent. |

Militia.

| | |
|----------------------------|---------------|
| New Mexico | 100 per cent. |
| Rhode Island | 100 per cent. |
| Utah | 80 per cent. |
| Massachusetts | 76 per cent. |
| Ohio | 62 per cent. |
| Indiana | 60 per cent. |
| Pennsylvania | 56 per cent. |
| Connecticut | 50 per cent. |
| Missouri | 47 per cent. |
| Virginia | 38 per cent. |
| New York | 33 per cent. |
| Georgia | 29 per cent. |
| Illinois | 29 per cent. |
| Colorado | 25 per cent. |
| Texas | 25 per cent. |
| District of Columbia | 20 per cent. |
| Iowa | 20 per cent. |
| Louisiana | 20 per cent. |
| Michigan | 22 per cent. |
| New Jersey | 20 per cent. |
| Wisconsin | 20 per cent. |
| Minnesota | 19 per cent. |
| California | 13 per cent. |
| Alabama | 11 per cent. |
| Kansas | 0 per cent. |
| New Hampshire | 0 per cent. |
| Oregon | 0 per cent. |