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General of the Armies of the United States

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Methods of Fire Adjustment

By Brigadier General R. E. Callan, *U. S. Army*

1. Recently I contributed an article to the Journal on the subject of Adjustment of Fire,* in which I touched upon a number of questions affecting artillery fire. I endeavored to show that ballistic methods alone were not always sufficient; and that adjustment of fire, as a result of observation, was necessary in many cases in order to get and keep the center of impact on the target. The train of thought thus started, has led me to prepare the following paper giving some of my views on the *Methods* of Fire Adjustment. My endeavor here is to present in a sequential manner such of the Principles of Least Squares, flowing from the Theory of Accidental Errors, as apply to problems in artillery fire; to warn young officers that these principles have only a limited application to firing problems because the deviations are not solely caused by Accidental Errors; and to suggest Methods of Adjustment that apply to artillery firing when the variations in the deviations are due to any combination of accidental, systematic and varying non-accidental errors. The order in which the discussion is presented, as well as the nature of the elementary matter considered, is chosen with the view of expressing in terms that cannot be misunderstood the points which I wish to bring out.

2. In using instruments of precision, it is noticed that repeated efforts to measure the same thing time after time give different results.

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Theoretically the results should be the same; practically they are not. Why? Errors creep in. These errors are divided into two classes.

a. Accidental errors.

b. Other errors which may be

(1) Constant (called systematic).

(2) Varying (they may or may not follow some observable law).

3. Normally in scientific experiments, great care and ingenuity eliminate the effects of errors in class *b*, leaving only those of class *a* (accidental errors) to be dealt with. Since these errors obey two laws:

First, that there will be just as many minus as plus in the long run;

Second, that there will be more small ones than large ones; it is a fair assumption that accidental errors will entirely disappear from the mean of an indefinitely large series of independent observation of the same quantity under precisely the same conditions. Therefore if all errors of class *b*, paragraph 1 above, be eliminated either before or after the observations are made, the arithmetical mean is the most probable value of the quantity measured.

4. In practice, however, an indefinitely large number of observations cannot be made, and no two observations can be made under exactly the same conditions. Therefore, when the computations have been freed of all errors which human ingenuity can eliminate, there still remain to be dealt with:

a. Accidental errors.

b. Traces of other errors. (Normally neglected.)

5. The Theory of Errors and Method of Least Squares shows how to obtain from the independent observations, whether expressed directly as simple observations or indirectly as complex equations:

a. The best determination of the value of the quantity measured.

b. A measure of the degree of precision of each observation.

c. A measure of the degree of precision of the final determination of the quantity measured.

In simple problems, *a* is formed by the arithmetical mean, *b* is expressed by the error which is as likely to be exceeded as not; (the latter is called the probable error) and *c* is expressed in turn by its probable error. For instance, let r be the probable error of one observation (or one measured deviation). Then, if the arithmetical mean of several observations is taken as the best determination of the value of the quantity measured, its probable error is $\frac{r}{\sqrt{n}}$

6. In artillery fire we have two classes of errors:

a. Accidental errors.

b. Other errors due to:

(1) Personnel.

(2) Materiel.

(3) Basic firing data.

7. If, in a practice, all firing data were correct and if all conditions, including that of the air, remained constant, the only errors to be dealt with would be accidental; a series of shots fired under such conditions at a fixed target would be grouped about the target in accordance with the laws of accidental errors. Such firing could not be improved upon by the artilleryman. In a limited number of shots, the number of actual hits would be governed by chance. If, however, there were a constant error in the firing data, caused say by using the wrong velocity or by not knowing the retardation caused by the air (other conditions being the same as above) the series of shots thus fired would be grouped about a point called the center of impact of the group which would be at a certain distance from the target. In this second case, after firing a limited number of shots using the basic data, further firing could be improved by the artilleryman whose problem would now be to determine from the first few shots the longitudinal and lateral corrections required to place the center of impact on the target.

8. It is a useful fact that if we fire a series of shots at a target and consider the longitudinal deviations from the center of impact in the cases described in paragraph 7, (there appear to be two cases but in reality they are the same for in the first the center of impact is on the target) and divide the distance between the limiting shots by eight, the following percentages of the total shots will generally be found in the consecutive eighths commencing from either extremity, 2%, 7%, 16%, 25%, 25%, 16%, 7%, 2%. These percentages show that there is a fifty-fifty chance that any shot, which is an over, will fall within the first eighth on the "over" side of the center of impact, and the same chance that any short will fall within one eighth on the "short" side of the center of impact; that, neglecting the question of over or short, there is a fifty-fifty chance that any deviation, considering its magnitude only, will be less (or greater) than the width of one of these eight bands. This width is called the probable error of any shot of a series. Four of these are called a fork; and eight of them a ladder.

9. Paragraphs 7 and 8 provide the basis of two lines of procedure which may be followed to put the center of impact on the target (for range) when the range deviations are affected by accidental errors and, at the same time, the displacement from the target of the center of impact is due to some constant error. If, in firing a series of shots, we find that the first few all fall short, it is evident that bold plus corrections are needed until some of the shots begin to fall over. When this state of affairs is reached, the dispersion ladder is covering the target and the percentages shown in paragraph 8 furnish the basis of methods which provide prompt adjustment. For instance, if both the sense and magnitude of the longitudinal deviations are known, a fairly close approximation of the limits of the dispersion ladder can be quickly determined and a correction made which will move the center of the ladder to the target. If only the sense of the impacts is known and if 2% are short and 98% over (that is, about 1 to 50) a change in elevation is necessary to decrease the range of the shots by three probable errors; if 9% are short and 91% over (about 1 to 10) a decrease in range of two probable errors is required; if 25% are short and 75% over, a decrease of one probable error must be made. Upon these principles therefore are based all of the refinements of the various methods of fire adjustment which use the dispersion ladder. The value of this general method in field firing and in firing major caliber fixed armament when the magnitude of the deviations cannot be obtained, or if obtained cannot be depended upon, is apparent.

10. The preceding general method was, in the last analysis, one whereby the total correction for the constant error was determined by successive increments. We will now consider the other method, based on paragraph 7, of determining the longitudinal deviation of the center of impact from the target; not by a process of summation but by a direct application of the principles referred to in paragraph 2 to 5 inclusive; *we will determine the most probable value of the constant error from measurements that will have accidental errors in them.* This method is called the trial shot method. Under the conditions of the problem let a series of n shots be fired at the fixed target. The mean of the longitudinal deviations will be the most probable value of the longitudinal coordinate of the center of impact from the target; it is the best determination of the desired range correction that we can get. The range coordinates of distance of the shots from the center of impact can be determined from these data and if their mean is taken and multiplied by .845 we have the probable error of

each shot of the series, the reciprocal of which measures the precision of each shot. If this probable error is divided by $\sqrt{n}$, we have the probable error of the determination of the correction which we obtained when we took the mean of all the measured range deviations of the n shots. There naturally arises the thought how many trial shots should be fired to determine the constant error which after all is nothing but the correction of the moment. Let us consider this.

Let r = the range probable error of the gun.

Then r = the probable error of the range deviation of any shot fired.

$\frac{r}{\sqrt{n}}$ is the probable error of the correction which is obtained by taking the mean of the range deviations from the target.

$\frac{\sqrt{n}}{r}$ is the reciprocal of this probable error and measures the *precision* of the determination of the correction.

Under the hypothesis that we are dealing with, that is, the errors consisting of accidental errors and one constant error, the precision increases with the square root of n.

With 9 shots the precision is 1½ times as great as with 4 shots.

With 16 shots the precision is 2 times as great as with 4 shots.

Now under the conditions, the *precision* measures the *accuracy* of the determination; and we see that more than doubling four shots increases the precision, and therefore accuracy of the determination of the range correction, by only 50%. It might be worth using more than four shots if conditions in actual practice let us always deal with a constant error. Unfortunately, the atmospheric conditions so often do not remain constant, thus causing the thing we are measuring not to remain constant. In reality it is often stretching or shrinking, so to speak, by reason of atmospheric changes. The mathematical precision of our method ceases to indicate the accuracy of the measurement of the correction. A greater number of shots than four may thus give no increase whatever in the accuracy of the correction determined. Therefore, taking all things into consideration, four trial shots is a reasonable number to take.

11. We will pause at this point of the discussion and consider the derivation of the method given for determining the probable error; that is, taking the mean of the range deviations and multiplying it by .845.

12. Suppose n shots to be fired from a cannon with a source of constant error in the firing data, and with accidental errors affecting

each shot. By means of the measured range deviations we seek to find:

a. The most probable value of the range correction necessary to compensate for the constant error.

b. The probable error of any measured range deviation.

c. The probable error of *a*.

It is further assumed that all measured deviations are equally trustworthy or, in other words, the weighted values of the observations are all the same. From Least Squares,

a. The most probable value of the range correction in 12 *a* is the arithmetical mean of the measured range deviations.

b. The probable error of each of the measured range deviations is $r = 0.6745 \sqrt{\frac{\Sigma v^2}{n-1}}$ in which Σv^2 is the sum of the squares of the residuals; (the residuals being the value of the observations minus the value which we take as the final determination of the true value). We can take the arithmetical mean of the deviations as the "final determination of the true value" and proceed as follows:

Let $x_1\ x_2\ x_3 \ldots x_n$ be the observed deviations; then

$$\frac{x_1 + x_2 + x_3 + \ldots x_n}{n} = a$$

and the residuals are

$$(x_1 - a),\ (x_2 - a),\ (x_3 - a), \ldots (x_n - a)$$

$$\Sigma v^2 = (x_1 - a)^2 + (x_2 - a)^2 + (x_3 - a)^2 + \ldots (x_n - a)^2$$

By substituting in the equation $r = 0.6745 \sqrt{\frac{\Sigma v^2}{n-1}}$, the value of Σv^2, the probable error of any measured deviation is found. Divide the probable error r thus found by the $\sqrt{n}$ and the result is the probable error of the most probable value of the range correction (that is, of the arithmetical mean).

13. The process of determining r in the above manner is very laborious by reason of the great number of residuals that must be squared. We will therefore seek a simpler way of doing it even if it is not quite so accurate. This can be found in a roundabout way in Least Squares by considering the mean absolute error which is the mean of the absolute values of all the errors (that is disregarding signs). Its value is $\frac{1}{h\sqrt{\pi}}$; the value of the probable error is $\frac{.4769}{h}$; therefore the probable error equals the mean absolute error multiplied

by .845. Now an approximation to the mean absolute error is obtained from $\frac{\Sigma\,(x-a)}{n}$; and if the arithmetical mean is used for the true value of the quantity whose most probable value is being sought, that is substituting the arithmetical mean for a, the above expression for the approximate value of the mean absolute error becomes $\frac{\Sigma(v).}{n}$ Multiplying this by .845 we get a close approximation to the value of the probable error, or $r = \frac{.845\ \Sigma(v)}{n}$. To apply it, we take the mean of the range deviations from the center of impact (disregarding signs) and multiply by .845. This is the rule referred to at the end of Paragraph 11.

14. The foregoing provides a simple method for finding the probable error of any one of n shots. How good is this probable error? In other words, what is the probable error of this probable error? What is its value for different values of n? How large should we ever make n? The answer may be found derived in Merriman's "Method of Least Squares," 8th edition, pages 206-208. When based on consideration of the mean squared residual the expression for the probable error of the probable error is $\frac{.477\ r}{\sqrt{n}}$; when based on consideration of the mean absolute error the expression is $\frac{.510\ r}{\sqrt{n}}$. Taking the latter expression and substituting values for n from 1 on up:

$n = 1$ then $\sqrt{1} = 1.0$ and the probable error of $r = .510\ r$.

$n = 2$ then $\sqrt{2} = 1.4$ and the probable error of $r = .361\ r$.

$n = 3$ then $\sqrt{3} = 1.7$ and the probable error of $r = .294\ r$.

$n = 4$ then $\sqrt{4} = 2.0$ and the probable error of $r = .255\ r$.

$n = 5$ then $\sqrt{5} = 2.2$ and the probable error of $r = .228\ r$.

$n = 6$ then $\sqrt{6} = 2.4$ and the probable error of $r = .208\ r$.

$n = 7$ then $\sqrt{7} = 2.6$ and the probable error of $r = .193\ r$.

$n = 8$ then $\sqrt{8} = 2.8$ and the probable error of $r = .180\ r$.

$n = 9$ then $\sqrt{9} = 3.0$ and the probable error of $r = .170\ r$.

$n = 10$ then $\sqrt{10} = 3.2$ and the probable error of $r = .161\ r$.

$n = 15$ then $\sqrt{15} = 3.9$ and the probable error of $r = .132\ r$.

$n = 20$ then $\sqrt{20} = 4.5$ and the probable error of $r = .114\ r$.

$n = 25$ then $\sqrt{25} = 5.0$ and the probable error of $r \doteq .102\ r$.

$n = 40$ then $\sqrt{40} = 6.3$ and the probable error of $r = .081\ r$.

$n = 100$ then $\sqrt{100} = 10.$ and the probable error of $r = .051\ r$.

Roughly speaking then:

If r were determined by 5 shots its probable error = r/4
If r were determined by 10 shots its probable error = r/6
If r were determined by 15 shots its probable error = r/8
If r were determined by 20 shots its probable error = r/9
If r were determined by 40 shots its probable error = r/12

These are interesting data, and they would stand out more clearly if plotted on cross section paper; the ordinates being taken as percentages of r and the abscissas being the number of shots. It is quite clear that ammunition is wasted after twenty shots for the difference between the probable errors of the determination of the gun's probable error for forty shots and twenty shots is only 1/30 of r. The foregoing is of interest in the study of range table and calibration firings.

15. Going back to the end of Paragraph 9, we take up the thread of our discussion again by remembering that we saw two ways to obtain the range adjustment when accidental errors and one constant error were being dealt with.

a. By utilizing the principle that the percentage of shots in the various subdivisions of the dispersion ladder were rather constant in the long run, and thereby, as it were, slipping the ladder up and down.

b. By utilizing the principle that the most probable value of the longitudinal correction sought is the arithmetical mean of a number of deviations.

Naturally the same procedures apply in determining the lateral adjustment.

A variation of the second method is as follows. Fire the first shot and obtain the range deviation from the target. Apply this deviation *in full* (sign changed) as the first elevation correction; fire again, obtain the range deviation and apply *one half* of it (sign changed) as the second elevation correction; fire again and apply *one third* of

the deviation with its sign changed as the third correction, and continue the process to n shots. The total of the corrections by this method after n shots is exactly the same as that obtained by firing n shots with the same initial elevation and taking the mean of the deviations. This is shown by the following:

Let $a_1, a_2, a_3 \ldots a_n$ be the 1st, 2nd, 3rd, . . nth longitudinal deviations of shots fired by the trial shot method: the resulting value of the correction would be $\frac{a_1 + a_2 + a_3 + \ldots a_n}{n}$. Now if we had fired under identical conditions and had used the method of successive approximations (Whistler's rule) and had expressed the results in terms of the above deviations we would have:

1st correction

$$-\ (a_1) \qquad = -\ a_1$$

2nd correction

$$-\left[a_1 + \frac{(a_2 - a_1)}{2}\right] \qquad = -\left(\frac{a_1 + a_2}{2}\right)$$

3rd correction

$$-\left[\frac{a_1 + a_2}{2} + 1/3\left(a_3 - \frac{a_1 + a_2}{2}\right)\right] \qquad = -\left(\frac{a_1 + a_2 + a_3}{3}\right)$$

4th correction

$$-\left[\frac{a_1 + a_2 + a_3}{3} + 1/4\left(a_4 - \frac{a_1 + a_2 + a_3}{3}\right)\right] \qquad = -\left(\frac{a_1 + a_2 + a_3 + a_4}{4}\right)$$

nth correction

$$-\left[\frac{a_1 + \ldots a_{n-1}}{n-1} + 1/n\left(a_n - \frac{a_1 + \ldots a_{n-1}}{n-1}\right)\right] = -\left(\frac{a_1 + \ldots a_n}{n}\right)$$

16. Now before going further let us see again what we have accomplished, for it is easy to lose the thread in this discussion unless we take stock of what we are doing from time to time. We have dealt with a problem of fire at a fixed target in which many accidental errors occurred and one constant error (it may have been the sum of several errors). This constant or systematic error was one, most likely, due to wrong firing data, and the chances are that the error was the thing hardest to determine before firing, that is *the ballistic correction for the retardation of the medium fired through.* Whatever the cause of the constant error, we found that it could be corrected for:

a. By using the probability ladder and getting the correction step by step. (It might be one step.)

b. By the trial shot method and getting the mean deviation; or what amounts to the same thing by using the successive approximation method, called Whistler's Rule.

c. By combining at some stage of *b*, the method of *a*.

17. So far we have considered the target as fixed; but if the target moves and we know its course and rate we may use the same basic principles and methods of adjustment. If our plotting, predicting and ballistic work is fairly accurate and if we are still dealing with accidental errors and one constant error the methods in Paragraph 16 above apply with very satisfactory results. It may be noted at this stage that under the conditions the method of Paragraph 16 *a* is used normally for the smaller caliber cannon, and the methods of 16 *b* and *c* for the larger calibers. To many artillery minds the problem ends here, but that is just where they are mistaken. No matter how well the firing data is determined, there are errors in it that affect the fall of the shots and these errors are often due to a varying retardation caused by wind and atmospheric changes. In other words, instead of the firing problem being one that involves accidental errors and a *constant* error, the case is frequently one that involves accidental errors and a *varying* non-accidental error. The methods of Paragraph 16 were based on the principle of accidental errors applied to the most probable determination of the value of the constant error. The case now in hand is far more complicated. Manifestly, if the varying non-accidental error (it may be the sum of several such errors) is always small compared to the accidental errors, or is changing so slightly as to be almost a constant error, then the methods of Paragraph 16, which are based on accidental errors, give a pretty good solution of the problem; but if these conditions do not obtain, that is, if the non-accidental errors are neither small nor slightly varying the methods of Paragraph 16 either cannot be used, or if used, must be modified to meet the different conditions.

18. Only by observation of fire can data be obtained that will enable a proper adjustment of fire under the last named conditions. Let us suppose that the velocity of the powder is fairly well determined and that by trial shots at a fixed point a fairly good initial correction is obtained that will cover the conditions of the moment so far as wind and atmosphere are concerned. Assume that fire at the moving

target is then commenced. If guns are used the accidental errors are rather large at long ranges and the method of successive approximations can be commenced. Plot the fall of the shots on cross section paper, and stripping each deviation of any adjustment correction applied, plot also along the corresponding ordinate for each shot its ballistic deviation. Whether or not what I call the ballistic deviations are generally constant will soon be manifest. If they appear rather constant it means that the ballistic corrections made in the plotting room are properly covering the retardation except for a constant error which the continued use of the method of successive approximations will soon compensate for. If on the other hand, the ballistic deviations on the range adjustment board do not appear constant but show a fairly clear law of change it means that the ballistic methods of determining the firing data in the plotting room are not based on sufficient knowledge of what changes are taking place in the wind and atmosphere. In such cases ballistic methods give erroneous firing data; and the errors not being accidental are not compensated by any method of adjustment of fire based on the principle of accidental errors. Something else must be done under such circumstances, and there are excellent data available on the fire adjustment board. The graph of the ballistic deviations shows the best available data for bringing the fire on the target and should therefore be used, preferably by predicting a proper correction.

19. The foregoing ordinarily applies to major caliber guns. In the case of mortars it is well to be perfectly frank and acknowledge that in the great majority of cases we have no way of making proper ballistic corrections for atmospheric changes. The mortar firing problem generally deals with small accidental errors and rather greatly varying non-accidental errors. Salvo fire is most suitable because the center of impact of each salvo corrects quite well for the accidental errors, and the deviation of the center of impact of the salvo gives the correction for the moment. The full correction should be applied each time till the law of the ballistic deviations of the centers of impact of the salvos becomes clear. Then predictions on the graph of the ballistic deviations of the salvo centers of impact may be of great value. In such cases it should be clear to everyone that methods of adjustment based on accidental errors are of no value; therefore it would be quite useless to follow the rule of successive approximations. The salvo center of impact method is unquestionably the best one

with which to commence a mortar shoot. If a constant retardation is met with (and it occasionally is) after a few salvos the target will be straddled by the salvos. If there is a varying retardation whose law becomes clear, the predictions for the proper corrections can easily be made on the range adjustment board. If there is a varying retardation whose law is not clear, there is no better method available than the straight salvo center of impact method.

20. The determination of the proper correction to be used in going from zone to zone has many difficulties attached to it. For a number of years the Coast Artillery did not face this question squarely. Target practices were almost entirely conducted in but one zone which left the zone to zone correction question an academic one. It was not until about 1911 or 1912 that the Chief of Coast Artillery ordered mortar practices to be conducted in at least two overlapping zones. Among the methods that were considered, before it became generally known that the wind effect often varied in intensity and direction in different strata of air, were the following:

a. A method based on the assumption that, for a given elevation, a correction of n yards in one zone should be used in the next zone for the same elevation.

b. A method that used a series of percentages for the different zones, to be applied to the flat correction determined in any zone. Because data is not available for applying ballistic corrections yet to mortar fire, there is prescribed in C.A.M. No. 4, W.D. 1923, the following rule:

c. "The trial or adjusted elevation obtained in one zone may be carried as trial elevation into any other zone by multiplying the flat range correction by a coefficient equal to the mid-zone (55°) range of the new zone divided by the mid-zone (55°) range of the zone in which the data has been established. Whenever fire is opened in a new zone, however, it will be necessary to establish a new adjusted elevation."

It is apparent that methods *b* and *c*, which involve flat corrections throughout a zone are of no value when the wind is varying appreciably in direction and intensity in strata of air reached by the different maximum ordinates of the various possible trajectories in one zone. For example, the analyses of the results of the 1922 and 1923 mortar firings in the Panama Coast Artillery District clearly show that a

flat correction throughout a zone is almost of no value whatever; it follows from the above that any fractional part of such flat correction would be of no value as a flat correction in another zone. There may be Coast Artillery stations where a study of the records will show the reverse of this to be true. The question is worthy of investigation; and if true, there is demonstrated the fallacy of requiring special case methods of adjustment to be followed everywhere. If any method is to be prescribed it should be one which would fit all possible conditions.

21. Method *a* of Paragraph 20, called Montgomery's Rule, was the first proposed if I am not mistaken. It has, what I consider, a basic principle which is approximately correct and of general application. This principle is as follows: When firing in the same general direction, there is some distinct relation between the correction for trajectories in two zones having approximately the same maximum ordinates; this means the projectiles are affected in their retardations by the same atmospheric conditions in the same strata of air. That the correction for one elevation in one zone should be exactly that for the same elevation in another overlapping zone is naturally open to criticism. All things considered, and this includes precious time saved from calculation of fractions, it should give at least a fair approximation. The principle of the method is in no way at variance with the fact that air conditions can be such that the corrections for all the different elevations in any zone can be the same; that is, under certain conditions a flat correction is proper. It is fundamental that corrections of any nature should be based on sound data. The data needed in such firing problems is the mean density of the air throughout the trajectory and the ballistic wind. The former can hardly be obtained; the latter can. It is highly probable that the variations in the mean density will be of slight consequence; if this is true we are in no great difficulty on that score as only a systematic error is introduced which we know causes no great difficulty in adjustment of fire. Our chief worry, we must remember, is in handling appreciably varying deviations that do not follow the law of accidental errors.

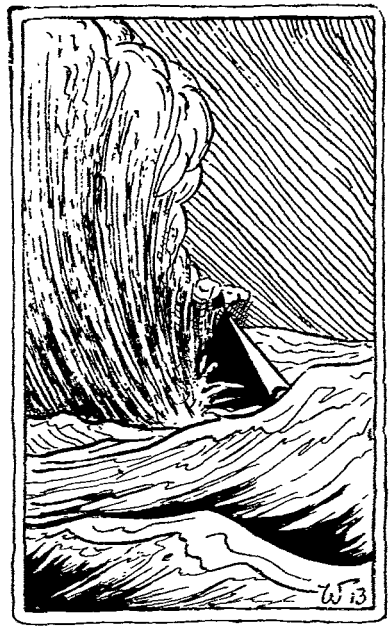
22. By all means, let mortar target practices and actions be preceded by a careful determination of the ballistic wind. With such data, suppose firing to be commenced in any zone; corrections corresponding to different elevations (using maximum ordinates as argu-

ments) can be determined, applied and recorded. At the same time the fire can be adjusted by the salvo center of impact method. By plotting the actual deviations of the centers of impact against a time horizontal axis on cross section paper and stripping these deviations of the adjustment corrections, the resulting ballistic shoot in that zone will be apparent. If the graph of the ballistic ordinates maintains a general parallelism with the time axis, it is clear that the corrections based on the ballistic wind covered the different retardations met with. Such an adjustment problem would be an easy one and when any systematic errors that might have been present, were promptly corrected by the salvo center of impact method of adjustment, the remaining salvos should have straddled the target.

23. If, however, the graph of the ballistic ordinates show a departure from general parallelism with the time axis the data is thus at hand which should be combined with the ballistic wind correction for each maximum ordinate used in that zone. There will result a series of corrections that, if applied to the proper elevations in a shoot that would cover the same course under the same atmospheric conditions, would keep the centers of impact of the salvos very near the target. Furthermore, this resulting series of corrections, corresponding to different maximum ordinates, will be most valuable in an overlapping zone, provided of course the firing is in the same general direction. The elements of this plan have been followed at some of the last mortar target practices in the Panama Coast Artillery District, and data have been obtained that give hope for good results when greater facility is had in using the ballistic wind. Of course where considerable changes in azimuth take place during a shoot, the resolution of the ballistic wind corrections into components is necessary.

24. Each locality has its own atmospheric problems. In order to determine as much as possible of the general laws of wind variation in intensity and direction throughout the year, hydrogen balloons are released from time to time at the principal Coast Artillery posts in the Panama District and plotted against time in their flights. It is quite possible that in such a locality as this, a few years of collecting such wind data will show some general laws applicable to the two seasons, wet and dry, that might prove extremely valuable in making retardation corrections in mortar fire. The studies based on these data and on past firings might enable simple correction charts to be

made so that a large part of the work that would be necessary in using ballistic wind data prepared from a balloon flight just preceding the firing, would be on hand and the balloon flight just before practice would be merely an index as to the correction data that should be followed.



Coast Artillery Instruction

By Colonel W. E. Cole, C. A. C.

PRIOR to the World War, it was the custom of the Chief of Coast Artillery to issue, annually, a Coast Artillery Instruction Order. The subjects in which the Coast Artillery was to be instructed were given in that order. The regulations governing both target and mine practice were given in great detail; the order further prescribed just who would be excused from the daily instruction.

In 1918 this Coast Artillery Instruction Order, as such, was not published, but Special Regulations No. 22, which prescribed the instruction for Coast Artillery troops was written. This regulation was superseded by a publication entitled "Instruction of Coast Artillery Troops, 1920." Since 1921 the instruction of Coast Artillery troops has been prescribed in Coast Artillery Memorandum No. 1, or in that memorandum as revised. This memorandum follows the general lines laid down in the 1920 instruction order. The "Instruction of Coast Artillery Troops, 1920" contains the following:

> *Kinds of practice.*—Subject to the subcaliber and service ammunition allowances, each Coast Artillery district and brigade commander, with the approval of the next higher commander, will prescribe the number and character of the firing problems, for each organization under his command, and will issue the necessary regulations for the proper and safe conduct of the firing.
>
> It is expected that Coast Artillery district and brigade commanders will exercise, fully, their initiative in and responsibility for the methods of instruction and target practice.

This quotation is significant in that it indicates the policy that has, in general, guided the Chief of Coast Artillery in his dealings with Coast Artillery instruction since that date. It is made clear that the Chief of Coast Artillery desires the older officers to exercise fully their authority in the development and training of the Coast Artillery troops. He in no way limited higher commanders in their methods of training, nor in the methods of carrying out Coast Artillery firings. He did state the following:

> As far as practicable, officers will be required to perform, in connection with service firing, the duties of their tactical assignments. Officers and enlisted men may be attached temporarily to an organization for a particular firing problem when additional personnel is necessary for the efficient conduct of the problem.

Reports are submitted at the end of each target practice season by the coast defense commander, and other field officers of his command, setting forth in detail the manner in which the instruction has

been carried out. Comments are made on the target practices, and recommendations are made in reference to the training, instruction and materiel of the Coast Artillery. These reports are commented upon by district commanders who make further recommendations looking to the advancement of the Coast Artillery training and instruction, and the betterment of Coast Artillery materiel. The reports furnish the Chief of Coast Artillery with information regarding the state of training of the Coast Artillery troops in each particular district.

A study of the reports of Coast Artillery training and target practice that were held under the 1920 Instruction Order led to the publication of Coast Artillery Memorandum No. 2. This memorandum called attention to the fact that many batteries were conducting firings for which they had had but little training, and further, that many of the older officers did not exercise fully their authority in the training of their commands and in the conduct of target practice. Some of the commanders had target practice with batteries that were untrained, and permitted the use of methods of fire adjustment that were inapplicable, especially with untrained batteries. The following quotation is taken from the Annual Report of the Chief of Coast Artillery, 1921, and expresses his views in regard to the 1920 training:

> There is no doubt that one of the causes of the unsatisfactory work of 1920 was due to a radical change in the methods of conducting target practice. Prior to this, practice had been held under rules and regulations prepared in this office, which prescribed the procedure in great detail. The instruction order for 1920 eliminated these details in every possible way. The general object to be attained was set forth, leaving the methods to the initiative of the commanding officers. In spite of the defects developed and which may be partially attributed to this policy, I am convinced that the policy is correct and that the service will eventually develop farther and faster than under previous restrictions.

The Chief of Coast Artillery did not desire to dampen the enthusiasm of the older officers, but he did feel that it was necessary that there should be restrictions placed upon them in regard to the methods that were to be employed in adjusting fire. With this object in view, Coast Artillery Memorandum No. 4 was published. This memorandum prescribed that at least one-half of the ammunition that was to be expended in target practice should be expended in accordance with certain generally accepted methods of adjustment of fire. The object of this memorandum was to insure that Coast Artillery officers would have a knowledge of standard methods of fire adjustment and to cause them to study these methods, thereby gaining a proper realization of the value of each method and its

special application. The Chief of Coast Artillery has stated it this way:

> While the underlying principles of fire adjustment are simple, their effective application may be difficult, especially so when the target is moving rapidly as will be the general case with naval vessels. This is a matter, therefore, which may frequently call for the exercise of trained judgment rather than arbitrary rule of thumb. Nevertheless, certain well recognized methods should be thoroughly understood and every battery commander should be trained in their use, until he recognizes fully their values and will not lightly abandon them in practice or action.

But not to be too arbitrary and arrest development, authority was given Coast Artillery officers to adjust a part of their fire by methods other than those contained in Memorandum No. 4, provided the methods of adjustment received the approval of the coast defense commander. In deciding as to whether a particular method was applicable, the coast defense commander was instructed to be guided by the principle that any method of adjustment used must be practicable and must be such that it could be continued during a period of time that an action might be expected to continue.

The reports received from fort, coast defense, and district commanders since 1920, especially those received during the past year, indicate that the older officers (as a rule) realize their responsibility, and are taking a very keen interest in the instruction and training of their commands. It is to be regretted that there are a few marked exceptions to this rule, but not enough to warrant any change in policy. In some instances, too, the submission of target practice reports has been so long delayed that a part of the value of the reports is lost.

The reports on the 1923 training from the Panama Coast Artillery District indicate that there is an interesting and active state of training in that district. The district commander has commented very fully upon the training and firings in his district. A copy of the report has been furnished the Commandant of the Coast Artillery School for the information of officers under his command. The reports from the Third Coast Artillery District were interesting and touched upon several subjects that are worthy of study; I refer especially to the target practice against a supposedly fast moving target. And so in other districts, each one is solving some particular problem, coordinated, as is necessary, by the Chief of Coast Artillery.

The reports in general bear out the opinion of the Chief of Coast Artillery that the development of the initiative of officers will follow when they are not too restricted by those in authority.

Observation and Adjustment of Fire

There has been considerable discussion among Coast Artillery officers about spotting, the value of observation of fire, and the adjustment of fire. Some feel that we have gone too far in permitting adjustment of fire to be made as a result of observation of fire at moving targets. They feel that we should go back to the prewar period and forbid officers adjusting their fire other than to make the ballistic corrections determined from meteorological observation and corrections as a result of trial fire.

An examination of target practice reports would, I think, bear out the contention of officers that spotting is a great source of error in Coast Artillery firings. This, I believe, is due largely to the improvised material that has been issued for spotting, and to the haphazard way that some spotting details have been trained. An observer, spotting, must be just as well trained as any other observer in the battery. The equipment used by the spotting detail must be accurate, or, necessarily, the results will not be so. Further, too much dependence has been placed upon the spotting. In some instances, careful preparation prior to target practice has not been made. A few officers have felt that this careful preparation was not so necessary since correction for the deviation of shots from the target could be overcome by applying corrections, based on observation, to succeeding shots. This reasoning was, of course, wrong. It requires just as much care in the preparation for target practice with spotting as it does when spotting is not required. In fact, more care is required, since the training of spotters is an added burden to the battery commander. When the ranges are short and the supply of ammunition is limited, spotting, except as a matter of training, is not so necessary. It is believed, however, that observation of fire and corrections as a result of this observation are a necessity and should form a part of the instruction of a Coast Artillery organization. A well trained organization will spot to advantage; an untrained one will add to its errors by spotting.

In preparation for the fire control of long range guns provision will be made for observers' stations for spotting, and no doubt, in the future a regular spotting board will be adopted. It is not contemplated at this time to build stations for the old armament, and stations that are used for that purpose with that armament will have to be improvised. For our greatest ranges it will be necessary to use airplane observation. It is obligatory that this method of observation be developed under the guidance of experienced officers and with well trained organizations. Unless great care is taken in

the preparation and training for target practice with airplane observation, the result of the practice will be of no value. District commanders are alive to the necessity for the development of airplane spotting, and where facilities were available have conducted experiments along that line, and no doubt will continue to do so.

In regard to the methods of fire adjustment. You are all, no doubt, familiar with C. A. M. No. 4, as revised, and the methods of fire adjustment described therein, as well as with the classification of fire as given in that memorandum. The general idea underlying those methods may be stated about as follows:

The trial fire phase is carried out by firing a limited number of shots—three or four—in a deliberate manner; great care is exercised during this firing to locate accurately the fall of the shots. The variation of the center of impact of these shots from the point aimed at is determined. The correction for this variation is, in general, applied to succeeding shots as a velocity correction at batteries where the Pratt Range Board is available; at other batteries it may be applied as a percentage correction, or as a flat correction. If the point aimed at is a fixed point and no corrections are applied until the completion of this phase of the firing, it is the trial shot method. If corrections are applied successively after each shot the value of the correction depending upon the number of the shot in the series then it is called the method of successive approximations. Mathematically these methods are the same.

After the firing of the trial fire phase and the application of the corrections as a result of that firing, no corrections are applied until at least four shots have been fired. This particular phase of the firing is called the improvement phase. The fire for effect phase may follow the improvement phase without cessation of firing, and the correction, if any, that follows as a result of the improvement phase of the firing applied to the sixth or seventh shot as the case may be. I think one would be perfectly justified in continuing in this manner if a straddle was secured in the improvement phase; otherwise not. The fire for effect phase follows the improvement phase and corrections may be applied at any time when results warrant it. In determining when to make corrections during fire for effect the ratio of overs to shorts should be considered. If straddles are being secured corrections may not be required, but if there are three overs or three shorts in succession it is believed corrections are obligatory. Corrections are determined as a result of the measured deviations of three or more shots. If deviations are not reliable and the "sense" of the shots is known, the correction should be determined as is called for by the Bracketing Method.

I have stated that the correction determined as a result of trial fire is applied through the velocity curves or as a percentage correction. This result follows, it is believed, when the velocity has not been determined by actual measurement. Corrections determined as a result of observation of fire at any time during the firing may be so applied. When the velocity has actually been measured, as reports indicate was done in the Canal Zone, it then ceases to be an unknown factor, and it may be advisable to apply corrections made as a result of measured deviations to the atmosphere curves. This particular phase of the subject requires more study.

In C. A. M. No. 4 is stated that the Salvo Center of Impact Method is applicable to batteries consisting of four cannon. I believe this is especially true for long range firing with our largest caliber guns. It is thought that by using this method under such conditions more effective fire will be secured, and observation of fire will be better. The Commanding General, Panama Coast Artillery District, approves this method of firing for mortar batteries even with but two mortars per battery. It is to be noted that trial fire is authorized with this method.

The Bracketing Method should not, I think, be used when accurate measured deviations can be obtained. Even with minor caliber batteries it should ordinarily be possible to fire the trial fire phase at a fixed point as is done in the case of the trial shot method. The method of applying corrections as described in the bracketing method should be clearly understood as its use is obligatory when the "sense" only, of the shots is known and it is desired to make corrections as a result of observation of fire.

The relative merits of the different methods of fire adjustment have been discussed considerably by Coast Artillery officers. This remark applies especially to the Trial Shot Method and the Method of Successive Approximations. The following are points to be considered in connection with the Trial Shot Method:

Trial shots are fired under conditions favorable to measuring the point of impact of each shot in reference to a fixed point. As a result of these measurements, corrections resulting therefrom are made upon reliable data.

Trial shots may be fired prior to the beginning of an engagement and little, if any, time need be lost in adjustment of fire after commencement of the engagement.

If, at the beginning or during an engagement, the fall of shots cannot be observed, the firing may be continued with a considerable degree of accuracy on data determined as a result of the firing of trial shots.

Considering the Method of Successive Approximations, the following are to be noted:

The fall of each shot must be observed and corrections based on the fall of previous shots applied to each succeeding shot. This requirement makes it essential that the organization so firing be particularly well trained. It is necessary that observation continue unobstructed during the trial fire phase. It is essential that there be sufficient time to permit of deliberate firing.

If the foregoing requirements can be met, the trial fire phase of this method may result in hits being secured on the target during this phase of the firing. Again, it will assure the commencement of the improvement phase of the firing immediately after the completion of the trial fire phase.

An officer conducting firing should have a clear understanding of the advantages and disadvantages of both methods. It is believed that there will then be no difficulty in determining the method to be used in the solution of a particular problem. For target practice the conditions of a problem must be assumed.

In discussing the adjustment of fire, I have used the expressions "trial fire," "improvement fire," and "fire for effect." This classification of fire, as you know, is given in C. A. M. No. 4. Some officers believe it advisable that this classification should be omitted in that memorandum. They give as their reason that there is not a strict division between the different phases, especially between improvement fire and fire for effect. I believe that no confusion will arise from the use of these terms and that their use adds to the clearness of a description of the methods of fire adjustment; further, these terms are employed in connection with land firing. As Coast Artillery officers must be prepared to fire both at land and naval targets, it is best to use the same terms in describing fire when these terms are applicable to both land and sea firing.

General Remarks

The subjects in which a junior Coast Artillery officer must be instructed are many and varied. He must be prepared to command a battery and to fire efficiently at aircraft, at naval targets, and at targets on land. In addition he must be prepared to plant submarine mines and operate a mine field. These requirements make it necessary for a Coast Artillery officer to be efficient with weapons varying from the pistol to the 16-inch gun. It can hardly be expected that officers will be efficient in all of these weapons at all times; but he must have more than a general knowledge of all of them and be particularly efficient with the weapons to which he is assigned It is expected that the Battery Officers' course at the

Coast Artillery School will so prepare an officer that he can efficiently handle any Coast Artillery weapon. From this School he may be sent to duty with units armed with any of the weapons to which Coast Artillery troops are assigned, or he may go to an R. O. T. C. Unit, or National Guard organization. I think it is apparent that the responsibility for the training of battery officers is very great. Each officer, at the close of the instruction on any particular armament, should ask himself whether or not he is prepared to give instruction in such armament and if not he should make an extra effort to inform himself in regard thereto.

So, too, with field officers of the Coast Artillery Corps. They must be just as fully informed as the junior Coast Artillery officer on the technique of all Coast Artillery weapons. In addition, they should be able to train efficiently our largest Coast Artillery units, and when necessary, to act in conjunction with other branches of the Army. Further, Coast Artillery officers must be prepared to take their fair share of the responsible positions that devolve upon Army officers as a whole. It is believed that the Advanced Course extended as it will be during the coming year will be a milestone on the road to such accomplishment. The General Staff School and the War College carry on the instruction, especially that which concerns the combined action of all branches and services.

I do not wish to be understood as believing that these schools can make the finished officer, and that in no other way can one succeed; there are too many exceptions on both sides of the question to warrant such a belief. These schools establish courses of study that will serve as a guide to officers in their reading. It must not be forgotten, however, that experience, common sense and sound judgment will ever assert themselves.

"We are not a military nation. Our army is so small as to present an almost absurd contrast to our size. * * * Yet we are a rich nation, and undefended wealth invites aggression."—*Theodore Roosevelt.*

The Functions of Coast Fortifications in the Positive System of Coast Defense

By Major E. J. Cullen, C. A. C.

Fire Tactics and Tactical Principles

THE tactical employment of artillery in coast defense operations is a subject to which much able thought has been given and concerning which there is some very sound doctrine. This is as it should be, for it is a matter of vital importance. But in the study of it, we, of the Coast Artillery Corps, have become so impressed with its importance that we have lost sight of the broader subject of the fundamental tactical principles governing the complete defense. We have failed to realize that the fire action of artillery against naval vessels is only a part of the total problem of the complete defense of the coast. At times we confuse the fire tactics of artillery with the tactical principles of the defensive. As a result, much of the doctrine we possess is somewhat vague and confusing and, in many instances, is in conflict with the accepted doctrine of the Army. As examples of this one may point to the oft-repeated references as to the *independent* mission of coast fortifications, and the *independent* command of coast artillery commanders. In tactical discussions, the use of the word *independent* implies exemption from all other control, and the absence of compulsory coordination with other elements. Then again one may point to that in Coast Artillery text that implies that heavy artillery occupies the primary position in coast defense operations and that the other arms are merely for its support. These are but a few illustrations to show the divergence of Coast Artillery teachings from the accepted doctrine of the Army. The latter teaches of the unity of command, of the mutual supporting action of all arms, and of the ultimate dependence of the artillery upon the infantry, since the artillery possesses only the power of fire-action and is incapable of shock-action, that other essential attribute of success. There can be no doubt that the final and ultimate defense of the coast, and even of the emplaced heavy-artillery itself, rests in the bayonet of the infantry. Nor is this to the disparagement of the artillery, for to it, in turn the infantry must look for that superiority of fire-power that is equally essential to the success of the complete defense.

Coast Fortifications a Coast Artillery Corps Subject

It is to the Coast Artillery Corps that the other branches of the Army must look for the tactical doctrine governing the use of coast fortifications and their mission in any system of coast defense. But with the vague and conflicting ideas that exist in our Corps today it cannot be expected that officers of other branches will obtain a clear grasp of the subject from a study of our literature and text. This is a matter of vital importance not only to the Coast Artillery Corps, but to the entire Army, and demands immediate action. Nor is the problem one that can be quickly solved by the haphazard compilation of a mass of vague ideas, expressed in high-sounding technical terms. Rather it is one that requires intensive study that will lead to the development of concrete ideas as to the fundamental tactical principles involved. These principles must be expressed in the accepted terminology of the Army so that all of us of the Army may read, and having read, we may understand.

The Positive System of Coast Defense an Army Project

The positive system of coast defense is an Army project for the defense of the coast. Though a certain amount of cooperation is contemplated and is expected from our naval forces, the entire project is distinctly an Army enterprise. As such, its conduct necessarily must be governed by the accepted tatical doctrine of the Army. The Coast Artillery Corps is a combat branch of the Army and its tactical doctrine must conform to the accepted Army doctrine in this project, as in every other. That is the foremost principle that must be borne in mind if we, of the Coast Artillery Corps, are to consider our Corps an organic part of the Army and are to expect its acceptance as such by the other branches.

The Defensive Position

A defensive position is an area occupied by a defending force, deployed both in frontage and in depth, and in formation adapted to the terrain. The organization of a defensive position is dependent upon the class of defensive action contemplated, whether active or passive; upon the strength, composition and duration of the probable attack; upon the frontage that can be covered effectively by the defensive fire; and upon the facilities afforded for the control and coordination of the action of all elements of the defense. In any case the defensive position consists of a main line of resistance occupied by certain elements of the defensive force, with the necessary support and reserve elements posted in rear and the approaches to the position covered by the fire of the various elements. The

mission of the defending force is to preserve the integrity of the defensive position, that is to prevent the penetration or the occupation of any portion of the defensive position by the enemy. A defensive position may be established for the strategic protection of remote areas or for the tactical protection of nearby localities. In the latter case, as in the defense of a harbor, unless the defensive position is established sufficiently in advance of the protected locality, the enemy artillery must be held back beyond its effective range if it is to be prevented from destroying the locality by its gunfire. But this is solely a matter of the fire-tactics of artillery and does not alter the fundamental tactical principles of the defensive. From the latter broad standpoint it is apparent that in any case the enemy must penetrate the defensive position, either physically or by his fire, or that he must occupy a portion of the defensive position, in order to effect the capture or destruction of the protected area or locality.

The Defensive Position in the Positive System of Coast Defense

In the Positive System of Coast Defense the entire coast constitutes the defensive position established by the Army for the strategic protection of the nation and for the tactical protection of the important localities on or near the seaboard. The defensive position must embrace every part of the coast, whether that part be near a harbor and occupied by units of the Coast Artillery Corps in permanent fortifications containing the heaviest types of artillery, or whether that part be an open beach occupied by other units of the Army in temporary fortifications containing only light types of artillery. Even though part of the coast be unoccupied, and merely held under observation, it must constitute a part of the defensive position. Anything less than this would be tactically unsound for it would violate the basic principle of the unity of command. It would be a grave error to accord to the permanent fortifications any functions or prerogatives that might exempt them in the slightest degree from the full control of superior command. The coordination of the action of these fortifications with the action of the other elements of the defense must be made a matter of definite control and not merely provided for by some scheme of mutual cooperation.

Basis of the Defense of a Position

The attack against a defensive position may consist of any form of operation ranging from the light quick thrusts by reconnoitering or raiding forces to the heavily-supported deliberate

assaults by the enemy main force. Between these extremes there are numerous possible methods of attack. In fact, the number is limited only by the resources, initiative and aggressiveness of the attacker. The defender, having surrendered the initiative, must be prepared to engage in combat at any instant, against any or all enemy forces whose approach may threaten the safety of the defensive line. He must halt their advance by the fire-action of his leading elements, and must drive them back by counter-attacking them with his reserve forces, using for this purpose the maximum effort practicable both in fire-action and in shock-action. By inflicting upon the advancing enemy forces such damage as to threaten their complete destruction in any continuance of the action, their withdrawal is compelled. If they fail to withdraw they must be destroyed. In either case the safeguarding of the integrity of the defensive position is accomplished.

Basis of the Defense of a Coast

The attack against a coast is an attack against a defensive position in which the naval forces of the attacker play the most prominent part, particularly in the initial stages and in the advance against the position. To meet this attack, the defensive force on shore is compelled to engage in combat against advancing enemy elements afloat, elements that are heavily armored, that are capable of most powerful fire action. and that possess great maneuvering ability. The defender is restricted to the passive defense because of his inability to execute a counter-offensive. The details of this form of defensive combat must differ in many respects to the general characteristics of defensive combat against an enemy operating on land. For example, one may point to the primary importance of the defender's heavy artillery in this form of defensive combat, as compared with the secondary part it plays in the defensive combat of ordinary land warfare. This primary importance is due solely to the fact that the heavy artillery is the principal arm available for combating the most dangerous enemy elements then threatening the defensive position, namely the armored naval vessels of the enemy. This artillery action is a most important phase and will have a direct bearing upon the ultimate success of the defense. It is one for which extensive preparation must be made by the installation of fortifications containing the heaviest types of artillery. Because of the time and labor necessary to construct fortifications of this character, and because of the necessity for their availability in the earliest stages of hostilities, these fortifications must be erected in time of peace. They must be of the permanent type, with a certain amount of fixed arma-

ment installed, and must be provided with facilities for the rapid emplacement of additional armament of the mobile type. The mission of the defense of the coast is the mission of the Army as a whole. The installation of these fortifications cannot make it the mission of any particular branch, either acting alone or supported by the other branches. In the defensive combat incident to the accomplishment of the assigned mission of the Army, each branch will play its distinctive part, according to its capabilities and limitations. In each phase of the operation it can be expected, therefore, that one arm may play a more prominent part that any of the others, since it may be more suitably adapted and equipped to meet the situation of the moment. But the complete defense demands the combination of the several arms to form a unit defensive force capable of effectively executing the fire-action or the shock-action necessary to meet all phases of the rapidly changing situation. This coordinated effort of these combined arms constitutes the Positive System of Coast Defense, and since it consists of the action of the combined arms it must be governed by the tactical principles and doctrine prescribed for the Army.

Artillery in Defense

In all defensive situations, the command of the artillery is centralized to provide the coordination necessary to insure that effective fire will be available for all critical points. The artillery is assigned to the support of sections of the defensive position in accordance with location, and full measures are taken to provide the necessary defensive fires. These defensive fires consist of counter battery fire against enemy artillery, interdiction fire against enemy forming-places and approaches, harassing fire against enemy rear elements, destruction fire against special and transient targets, and defensive barrages and concentrations for the close protection of the defensive position against direct assault. Until the direction of the enemy main attack can be determined the artillery is held in "readiness" or is employed upon such special missions as the situation may require. During the attack the artillery, by its defensive fires, furnishes the fire-superiority necessary to delay the attacking force, to break up its formations, to halt its advance, and performs an important part in the counter-attack made.

Artillery in Coast Defense

The outstanding feature of attack against a coast is the character of the primary elements of the attacking force as compared to that of the similar elements of an attack in land-warfare. In an

attack against a coast, the naval forces of the attacker play the most prominent part. The primary elements of the attack are naval vessels of various classes, battleships, cruisers, destroyers, submarines and such auxiliaries as mine-sweepers, mine-layers, transports, etc. This change in the character of the elements of the attack compels a corresponding change in the character of certain elements of the defense. This change is most noticeable in the character of the artillery required by the defense, and in the methods of its employment. The larger portion of the artillery of the defense must possess far greater fire-power than the artillery used in ordinary defensive situations, and it must be capable of effective action against fast-moving targets at normal ranges far in excess of the average ranges in land warfare operations. This condition compels the use of the heaviest types of artillery with necessarily elaborate systems of observation. From a tactical point of view the same classes of defensive artillery-fires are employed as in ordinary defensive situations, but the character of the fire-tactics and fire-technique used are modified to meet the change in the type of objective encountered. These modifications in fire-tactics and fire-technique are most noticeable in the methods employed in emplacing and controlling the artillery; the siting of firing-positions, the protected types of firing positions installed, the network of communications involved, and the methods of fire-control used. These modifications, together with considerations of the time and labor involved in accomplishing the installation nceessary, and the further consideration of the necessity, in the earliest stages of hostilities, for the existence of these elements of defense at the most important points on the coast, have brought about the installation of the present coast fortifications. But the existence of these fortifications has not altered the fundamental tactical principles governing "Artillery in Defense." Such fundamentals as the requirements for centralized control and coordination, the use of organized defensive-fires, the classes of defensive-fires necessary, and the tactical principles governing the use of artillery in the various stages of the combat, remain unchanged. The use of artillery in coast defense is governed by the accepted tactical doctrine of the Army, for artillery is an element of the Army, whether it be used on the coast or in the field.

The Functions of Coast Fortifications

A fortification may be said to consist of the installation of artificial works to increase the defensive character of the occupied terrain, and of the adaptation of the organization of the defensive

force to this terrain, in order to insure coordinated action in the use of the weapons of the defense. The present coast fortifications were installed for the emplacement of artillery intended for the tactical protection of certain widely-separated harbors and other important localities. These fortifications possess only the power to defend the protected localities against various forms of *naval* attack. They do not form that self-sustaining continuous line of resistance that constitutes a defensive position capable of the complete defense against any form of attack. The use of the name "Coast Defenses" in connection with these fortifications is unfortunate. It has given a false impression as to the security of the coast against attack, and it also has resulted in much confusion in the consideration of the operations for the defense of the coast. These fortifications are not "defenses," neither "coast defenses" nor "harbor defenses," within the full meaning of the word, since they are not capable of accomplishing the complete defense against every form of attack that might be made against the coast line or even against the protected locality. They are merely fortifications constructed for the emplacement of certain artillery and its auxiliaries and are intended solely for use against naval attack. They cannot be said, even, to contain the full amount of artillery that would be required to meet the strongest naval attack that might be made against the protected locality. They are only "Coast Fortifications." But they constitute very important elements of the defensive position that must be established in any positive system of coast defense, for they are suitably disposed, tactically, to render most powerful fire-action in support of the defense. Since fire-action is their principal characteristic and the primary purpose for which they were constructed, the functions of these coast fortifications may be determined by an analysis of the capabilities and limitations of their fire-action in the various phases of the complete defense. From such an analysis it can be readily determined that, in the Positive System of Coast Defense, the Coast Fortifications have the following functions: (a) To constitute the main element of the defense for combating enemy naval forces attempting to penetrate, occupy, or advance against the established defensive position. (b) To constitute a support element of the defense in the combat against enemy artillery, and in the combat against the direct assault of the defensive position. From a consideration of these functions it can be seen that the Coast Fortifications in the Positive system of Coast Defense will have the following missions:

a. To attack enemy naval forces attempting to penetrate or occupy the water areas within the defensive position.

b. To attack enemy naval forces attempting artillery action against the protected localities or against the defensive position.

c. To attack enemy naval forces attempting to advance to a point from which a landing may be made for the direct assault of the defensive position.

d. To attack the principal elements of the enemy forces engaged in debarking operations incident to a landing for the direct assault of the defensive position.

e. To attack enemy naval forces attempting to execute artillery action in support of a force engaged in the direct assault of the defensive position.

f. To conduct special defensive fires in close support of the other elements of the defense in combat against the direct assault of the defensive position.

The purpose of this article is to indicate the applicability of the tactical doctrine of the Army to the problems of the Coast Artillery Corps. The article is limited by its character, to illustrating that the tactical principles of the defensive are as readily applicable to coast defense as to any other defensive situation. A similar line of reasoning would prove the applicability of the other principles comprising the tactical doctrine of the Army. Then what could be more logical than to use the accepted terminology and phraseology of Army doctrine in the preparation of Coast Artillery text-books and the other literature of our Corps. It is only by conforming to the accepted language of the Army, the language common to all the branches of the Army, that we can hope to eradicate the present vague and conflicting ideas caused by our use of ambiguous terms and confusing phraseology. Then, and then only, will we be able to express in concrete terms, that can be clearly understood by everybody in the Army, the missions, operations and other problems of the Coast Artillery Corps. Then and only then will we be able to establish a standard and accepted tactical doctrine for the Coast Artillery Corps.

Pistols and Pistol Shooting

By Major W. D. Frazer, C. A. C.

Editor's Note: *This is the second of two articles by Major Frazer on Pistols and Pistol Shooting. The first appeared in the May, 1924, issue of* The Journal.

TO MASTER the art of pistol shooting, one must possess certain natural qualifications and the energy, will power and perseverance to develop a skill and technique which can be acquired only through a vast amount of training of mind, muscles and nerves. However, to master an art is one thing and to achieve success at it is another, and while most of us do not possess all the inherent qualities necessary to become preeminent, we can acquire a degree of expertness which is well above average and sufficient in itself to amply repay us for all our efforts.

If we take up pistol shooting strictly for pleasure and recreation we will probably approach it in a different way than if we had as our object the winning of a national championship. Again if we study the art with the purpose of mastering the theory and practice as part of our professional education, to be used later in more efficient instruction of men, we are apt then to solve the problem as we would any other that is incident to our profession and a necessary part of our technical training.

If we learn to shoot a pistol with reasonable assurance or knowledge that our life may depend on our ability to draw quickly and fire rapidly and accurately in a time of great personal danger, this responsibility will cause us to put forth a maximum effort to overcome the difficulties incident to learning the game and we will consider such efforts and the time devoted thereto as well spent. We will also, considering our purpose and viewpoint, approach the subject from an entirely different angle than we would were we considering recreation or professional efficiency as our chief objective.

The foregoing paragraphs are written not to discourage anyone, but rather to emphasize an accomplishment which is too often included in the same category with other forms of shooting all of which, as far as technique is concerned, are much easier to excel in than pistol shooting, though we have sometimes been taught to believe the contrary.

Rifle shooting with both small bore and service rifles is based on the same fundamental principles as is pistol shooting, but when

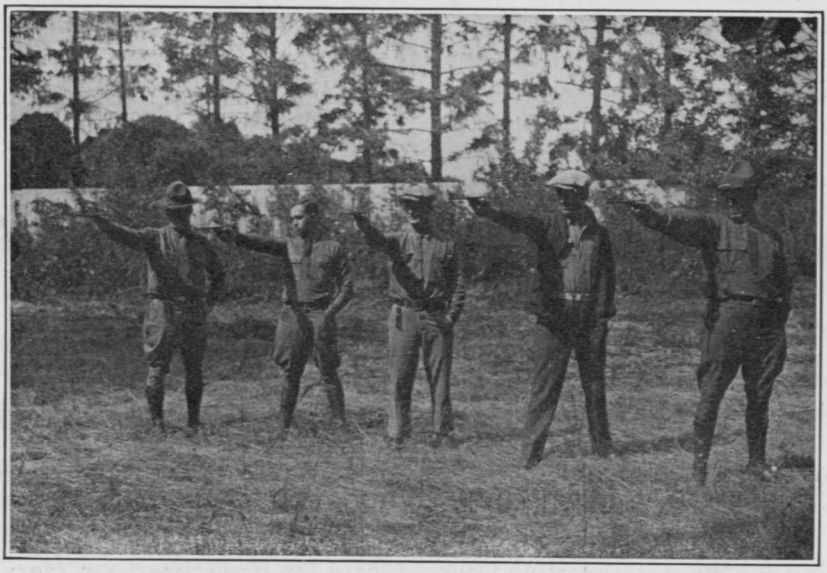
problems of wind, light, mirage, atmosphere density and temperature enter into this form of shooting and have to be solved in long range firing, then the game takes on a scientific aspect.

Shotgun target shooting at clay pigeons by a real expert is undoubtedly the best exhibition of a highly developed mechanical form of shooting, showing a wonderful coordination of mind and muscles in which the element of time is intimately associated with a moving gun and a rapidly moving target. Pistol shooting differs from rifle and shotgun shooting in many ways while based on similar fundamental principles. The wind problem is presented in a different manner. Principles of aiming, trigger squeeze and calling the shot are very much the same, while holding, or that ability to keep a pistol on a target with a minimum of movement during the time sights are being aligned and trigger squeezed calls for a highly trained set of muscles and nerves and incidentally a power of concentration and self-control not required in so marked a degree in other forms of shooting.

Among riflemen we sometimes find a tendency to belittle the pistol game, as something "unworthy of their steel." Apropos of this there is a tale worth telling. At a recent training camp of a certain service team where the best rifle and pistol shots of that branch were assembled for a final tryout for the selection of national match teams, it was found that there were several "Distinguished Marksmen" present who were not eligible to fire on the National Match rifle teams of that year because of certain recently changed rules. These men decided they would spend the tryout period training for the pistol team and thereby gain for themselves fresh glory and laurels in the form of a certain much coveted gold medal known as the "Distinguished Pistol Shot Badge." On first joining the pistol squad their attitude was one of mild interest in their work. Their desire for instruction was not evident and they gave the coach the idea that they felt perfectly at home and able to carry on successfully without any attention on his part. Within a few days these same men displayed a very different demeanor, which was one of pained surprise varied by violent exhibitions of disgust and temper, resulting in some cases in the throwing of pistols on the ground because they could not be made to perform as satisfactorily as the owner's rifles had been accustomed to do.

Finally realizing that self-control was one of the main essentials to success, the group settled down to practice with a great deal more respect for the game than they had previously shown. However, long habitual use of the rifle aided by two arms, a rifle sling, mother earth and various other accessories had made them so dependent on

these aids that when they were required to "stand up on their hind legs and shoot like a man" they found themselves much like small boats in a heavy sea. Incidentally, none of these "Distinguished Marksmen" made the Pistol Team. On the other hand, there are many cases on record of men, who, having first learned the pistol shooting game have been able with comparatively little practice and rifle shooting experience to make most excellent rifle shots. Pistol shooting will help one in rifle shooting, especially in the offhand style,



THE 1924 AMERICAN OLYMPIC TEAM, CHALONS, FRANCE

This Team won First Place for the United States. From left to right they are: First Lieutenant J. Whaling, U. S. M. C., First Lieutenant E. Andino, Inf., Gunnery Sergeant H. M. Bailey, U. S. M. C., Gunnery Sergeant B. G. Betke, U. S. M. C., and Major W. D. Frazer, C. A. C., the author of this article. Sergeant Bailey won the Individual Olympic Championship, with a run of fifty-four consecutive hits on the French Silhouette Target. Sweden took Second Place and Finland Third.

but the converse is not true except insofar as the basic principles are concerned.

When a novice is willing to accept as a fact the statement that it is harder to excel with the pistol than with rifle or shotgun, then, and only then, is he in the proper frame of mind to begin work with the hand gun. His acceptance of this statement will better prepare him to meet and overcome difficulties as they arise and furthermore he will be less prone to discouragement.

The most desirable assets any young man can possess who wishes to acquire, naturally and easily, the skill and technique so necessary to pistol shooting are, first and foremost, a healthy body

and mind; further specific qualities to be desired are an athletic physique, phlegmatic temperament, imperturbable disposition, good temperate habits and normal eyesight. A person possessing all the traits here enumerated would be an ideal subject to instruct, train and develop into a pistol expert. Most of us possess few of these attributes and still this lack should not be a matter for discouragement as shooting history is full of examples of excellent pistol shots who were handicapped by a minimum of natural attributes, but who, through a devotion to the game and an indefatigable perseverance, have so distinguished themselves as to almost disprove the rule by the number of brilliant exceptions. A man of nervous temperament frequently possesses certain distinctly advantageous traits which accompany such a temperament chiefly a tendency to react more rapidly in emergencies. A keen quick-acting brain often produces a greater accuracy of technique than is forthcoming in a more phlegmatic and unimaginative make-up, with the result that frequently we find such a man shooting marvelous scores. If this occurs, as has been known to happen, on the occasion of an important competition, the record so established may stand for years.

On the other hand, such an individual will probably have frequent decidedly off days when it seems to him that there is no depth to which he cannot sink—in other words, no score too low for him to make.

The man possessing the even temper and tranquil, unexcitable mind may never shoot as brilliantly as the impetuous, high-strung shooter when in top form, but on the other hand he can always be relied upon to shoot a good score and is ideal material for a team. He will usually produce a good score in a pinch when an anchor man is most needed.

Hints and Suggestions to Beginners

Regardless of his ultimate object in learning to shoot a pistol accurately and skillfully, the beginner should take up the game much as he would golf, tennis, swimming or any other interesting sport. He should get all the fun out of it he can. Knowing that anticipation frequently provides as much pleasure as participation, he should go slowly until he is thoroughly interested in his subject. Let him discuss the game with any friendly pistol enthusiast, read available books on the subject, obtain those sporting magazines that contain articles on the subject. Inspect the catalogs of reputable pistol manufacturers. He might even examine carefully the different pistols in the nearest large sporting goods store. In other words, let him work himself into the game before taking up the practice.

No one should buy his equipment until he feels reasonably sure he knows what he wants. The initial cost may be high, depending on individual taste, but this is so in any worth while game—and it never pays to buy cheap equipment.

Like selecting your first automobile, the purchase of a suitable pistol is difficult unless you know just what you want and the purpose for which you want it. Instead of deciding on an open or closed car, or between a four, six, eight or twelve-cylinder machine, you must instead decide whether you intend to do most of your shooting on an indoor or outdoor range, and whether you want a .22, .38 or .45-caliber weapon or one of the several "in-between" calibers.

At this point it is well to consider the various classes of pistol shooting practiced today, as the kind one prefers to follow has an important bearing on the proper equipment necessary to insure most advantageous progress.

Pistol shooting can be classified generally under three heads:

1. Military shooting, including slow, rapid and quick fire at stationary bullseye and disappearing silhouette targets, with military revolvers or automatic pistols.

2. "Free pistol" shooting or deliberate slow fire practice at either the Inter-National Target or the Standard American Target, time per shot or rate of fire unlimited. Specially designed single shot target pistols, with long barrels, adjustable target sights, special grips, light triggers including set triggers are used for this style of work. In this country this form of shooting has been confined to target pistols and revolvers with barrels not exceeding 10 inches in length, to a rate of fire of one minute per shot and a trigger pull not less than two pounds, the target used is the Standard American Target.

3. Snap shooting at moving targets such as objects thrown in the air, floating on the water or rolling along the ground. This may include practice in quick drawing of a pistol from holster or pocket, or the miscellaneous methods of shooting for fun at all kinds of targets including the ever popular tin can.

To a member of the military service it can be assumed that in addition to a desire to possess a gun that gives a maximum amount of pleasure to shoot, one wishes it to be the means of improving his shooting with the service pistol with which he is normally armed. Following this line of reasoning and appreciating the high cost of ammunition one should select a revolver or automatic pistol of small caliber, with which to shoot for pleasure and instruction. Practice with this arm will greatly aid in learning to use a weapon of larger caliber, arguments to the contrary notwithstanding.

Perhaps due to the fact that the automatic pistol is the latest development in hand guns and that a large percentage of good pistol shots both in and out of the service learned to use the revolver first, this weapon is much preferred by them to the automatic because of

its advantages over the service pistol in greater accuracy, better grip and balance, simplicity and safety. However, the automatic has the advantage of a greater number of shots, greater rapidity of fire and permits the execution of more rapid fire with greater ease to the shooter. The recoil being partially absorbed in the operation of the automatic mechanism, there is less punishing effect on the

THE 22.32 SMITH & WESSON H. F. TARGET REVOLVER. AN EXCELLENT REVOLVER FOR RECREATION AND TARGET SHOOTING

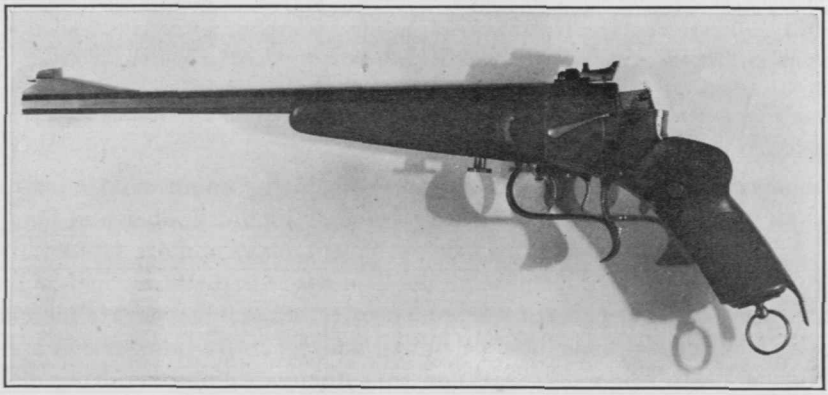
shooter's hand in the heavier calibers when firing an automatic pistol than would result from using a revolver of similar caliber and load.

There is no sport in which equipment plays a more important role than in pistol shooting and one's pleasure and success will be in proportion to the class of weapon one uses. Cheap inaccurate pistols with their crude, unadjustable sights, and generally poor design and workmanship are a source of constant annoyance and resulting discouragement in progress.

COLT AUTOMATIC PISTOL, CALIBER .22. TARGET MODEL. AN IDEAL ALL-AROUND TARGET PISTOL

There are not many good American target pistols of small calibers to select from so that a person desiring to use a .22-caliber weapon either pistol or revolver is necessarily limited to those of a few reputable firms. The relative merits of the different makes have long been the subject of considerable controversy among the shooting fraternity and no one can state definitely that such and such

weapons are the best because of the variance in taste of the individual shooter and because of the fact that each model usually has certain desirable features. There is no ideal weapon for everyone but one must select the one which suits him best considering his personal equation. The stock grips on most weapons are designed to fit the average hand. The effect of weight and balance of different pistols depends on the physical development of the man using the gun. For example, a heavy service pistol may soon tire the small man of slender physique, while the beautifully proportioned and balanced .22-caliber S. and W. target revolver may seem to such person the ideal arm.



THE "TELL" .22-CALIBER TARGET PISTOL
Length of barrel 14½ inches. Double set triggers. Special individual grip. Changeable front sights. Adjustable rear sight. Falling block action.

Based entirely on personal experience in the use of many makes and calibers of weapons, the writer unhesitatingly recommends certain favorite arms as among the best for the purpose of the beginner. For a .22-caliber target revolver, there is none better than the S. and W. 22-32 H. F. target revolver, sometimes known as the Bekheart model. This is an ideal weapon for target work and recreation in the open. The Colt .22-caliber target revolver would also be suitable. With either of these weapons, slow, timed or rapid fire can be successfully practiced.

To the service man for use in connection with the .45-caliber service pistol, the Colt .22-caliber automatic target pistol is the best weapon of its kind on the market today and has proved its worth for several years. Its great accuracy and perfect functioning, with reliable ammunition, combined with simplicity of mechanism and nice grip and balance make it the ideal weapon for rapid fire. Having a splendid barrel and long sight radius it is capable of doing most accurate

work in the hands of a good shot. The winning American Olympic pistol team used this weapon exclusively in the Olympic rapid fire maches of this year. The new Reising .22-caliber automatic sporting pistol has several very good features and promises when perfected to become a suitable pistol for target shooting.

For the man who desires to take up "free pistol shooting" with the idea of specializing in deliberate slow fire, a single shot target pistol is absolutely essential if he ever expects to rank among the leaders in this style of shooting. The weapon generally used for this work in the country by the majority of experts is the S. and W. .22-caliber single shot target pistol with 10-inch barrel. However, there is no American pistol on the market that can compete successfully with the highly perfected target weapons of Europe, which incidentally cost no more than our best American pistols. The fail-

.22-Caliber Smith & Wesson Single Shot Target Pistol. The most accurate American-made target pistol

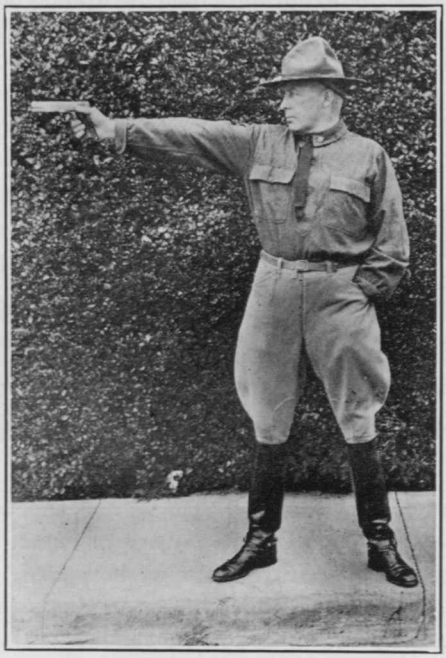
ure of our International Pistol Teams to successfully compete shoulder to shoulder with the best European teams in this *one style* of shooting clearly demonstrates that we lack something other than good shots, and a careful analysis of the methods and equipment of these foreign teams indicate that it is only because of their superior equipment and their long experience in its use that they are able to outshoot us repeatedly. The wonderfully balanced long barreled pistols, with great sight radius, smooth delicate non-jarring lock action, set triggers and carefully made individual grips give a decided advantage to the man who has learned to use them expertly. It is not believed advisable for a beginner to attempt to shoot with set trigger until he has thoroughly learned trigger squeeze with a heavier trigger pull. For men interested in .38-caliber shooting, there are several excellent target revolvers on the market.

It is not possible in an article of this length to cover in detail methods of instruction. The most that can be done is to offer suggestions that experience has taught to be of value.

Members of the service learning the game should carefully study "Pistol Marksmanship" and other books on the subject, then care-

fully observe the form and methods followed by our best pistol shots. After analyzing the different styles, one should be adopted which fits the individual physique of the beginner and thereafter that form should be followed without material deviation until it seems like second nature to assume it. The important thing to study is primarily, shooting form, or in other words, the shooting position. Unless one takes a steady, comfortable, well balanced position he unnecessarily handicaps himself by putting more muscles under

Note left shoulder and arm at ease. Head erect and turned well to the right. Both eyes open. Right arm fully and naturally extended without stiffness.



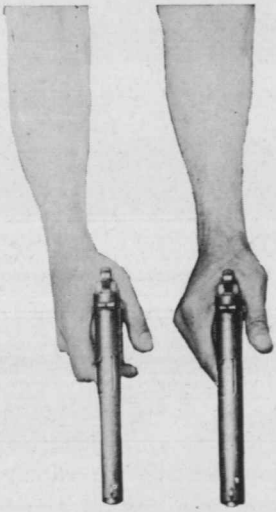
Note position of feet to prevent body sway. Body erect with weight equally distributed on both feet. Right shoulder slightly raised.

A NATURAL, COMFORTABLE, WELL BALANCED SHOOTING POSITION

strain than are requisite for the purpose. Extreme, unnatural or grandstand poses should be strictly avoided. Nervousness and the consequent unsteadiness always result from strained and fatigued muscles. One finds considerable variation in form among pistol shots, but a careful study of that followed by the best shots will soon indicate that in the main they observe certain principles. Again, it must be remembered that for a certain kind of shooting with a certain weapon one position might be better than another in a few details. For indoor shooting where the wind problem is absent and where one uses only a pistol of small caliber with little or no recoil and fires only slow fire it might be practicable for a person to keep his feet close together and even face directly toward the target and

still be well balanced and able to shoot good scores. But should a person of slender frame attempt to use this position for rapid fire with the service pistol out of doors with even a 10-mile breeze blowing he would find himself much handicapped due to his unstable position and the heavy recoil of the gun. It is therefore better to adopt a position suitable for any style of shooting and based on sound fundamental principles.

The position and distance apart of the feet and the equal distribution of the body weight on them is all-important and the deciding factors in maintaining equilibrium with a minimum expenditure of

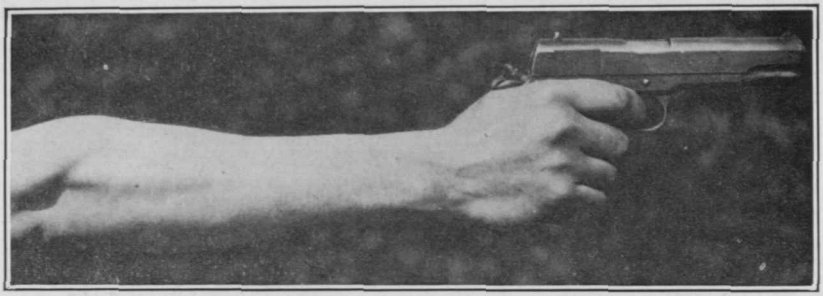


LEFT—*The wrong way to grip the service automatic. Pistol not in prolongation of the arm.*
RIGHT—*The correct way to grip the service automatic.*

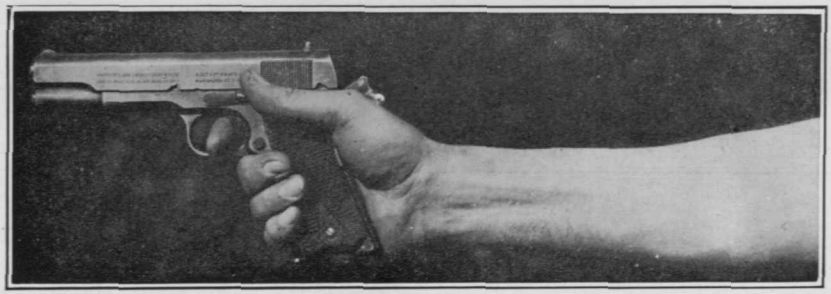
energy. A good position is one in which the body faces almost at right angles to the line of fire. For a man of average height the distance between the heels should be about 16 inches and between the balls of the feet about 22 inches. If we consider a vertical plane passing through the right heel, the extended right arm and the center of the target as the plane of fire, then the left heel should be about three inches to the left of this plane in order to prevent the body from swaying in a wind. The main result to accomplish is to take a position such that the body is *perfectly balanced with a minimum strain on any set of muscles.*

The position of the left hand when a man shoots with his right hand, should be such as to keep it out of the way and where it will aid in the balancing of the body. Placing it high on the hip raises the left shoulder and may cause a tiresome strain of the shoulder

muscles. A good natural, comfortable position for it is in the side trouser pocket, or even in the hip pocket, though it is believed the former is preferable. The shooting arm should be fully extended without rigidity and maintained in this position during the firing of each shot. The work of supporting the arm and pistol should be done mainly by the heavy shoulder muscles rather than by the arm muscles. This is accomplished by slightly raising the right shoulder. In gripping the pistol care should be taken to see that it is well



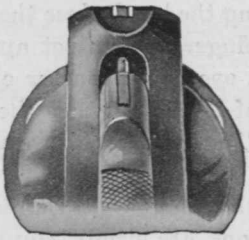
THE CORRECT WAY TO GRIP AND HOLD THE SERVICE AUTOMATIC. NOTE POSITION OF THUMB, TRIGGER FINGER, ARM AND WRIST



seated in the shooting hand. This is especially important with the service automatic because of the size and shape of the butt which does not fit the hand as naturally as does the revolver. The grip on the pistol should be as high as the particular weapon in use will permit, with the thumb extended naturally along the left side of the piece, the whole idea being to bring the barrel as nearly in prolongation of the arm as possible. The tendency with any large weapon is to have the hand too much on the right side of the piece so that the barrel is not directly in line with the forearm. This is especially true when using the .45 automatic. The grip on the butt or its position in the hand should always be the same. Permitting the grip to change from shot to shot may result in changing the elevation of your hits on the target. The pressure on the grip or the strength

used in holding the weapon in the hand should be only sufficient to hold it firmly, as firmly as one might hold an egg of questionable age; firm enough to be sure of not dropping it and yet not tight enough to crush it. To do either might be unpleasant. The heavier the caliber and recoil of the weapon the firmer must be the grip, especially in rapid fire. It must, however be constantly borne in mind that the tighter the grip on the weapon the greater the muscle strain and consequently the more nervous tremors in the hand. The modified trigger, grip safety and mainspring housing of the improved .45 Service automatic pistol will greatly facilitate the proper gripping of this weapon. These spare parts can be obtained directly from the Colt factory at very little expense.

APPEARANCE OF BULLSEYE AND SIGHTS OF "TELL" PISTOL WHEN CORRECTLY ALIGNED. FRONT SIGHT SHOULD BE JUST TANGENT TO BULLSEYE



NEW SMITH & WESSON MILITARY SIGHTS

In mastering the technique of pistol shooting there are certain main essentials that must be learned. These should be studied carefully and then every effort made to execute them exactly. The great problem before the shooter is one of physical and mental coordination. When he has assumed a correct shooting position and pointed his pistol at the target he has to concentrate on four things. He must align his sights properly or aim his gun. He must maintain these sights in alignment by holding his arm and pistol with a minimum of movement, and while so doing he must hold his breath and slowly squeeze the trigger when his sight alignment is correct, and then he must do still more and that is to think ahead and call his shot, or make mental note of the exact spot on the target on which his sights were aligned at the instant the piece was fired.

The principles of aiming are easily learned. There is only one correct method and that is known as the normal method or what years ago was known as taking a half sight. In this method the front sight should be centered in the notch of the rear sight for direction and the top of the front sight carefully aligned with the top edge of the rear sight for elevation. This is most easily and accurately done with a rectangular, or Patridge front sight, which just fills the notch of a rear sight having a horizontal upper edge. This form of sight is more generally used than any other for target

shooting. The line of sight thus formed between the eye and sights is then made coincident with the target preferably at the lower edge of the bullseye. Most good pistol shots keep both eyes open while aiming and firing. The beginner should learn this method of binocular aiming because of its natural advantages. However, the right-handed shooter whose left eye is the master eye may find it difficult to aim easily with both eyes open and he then has the choice of closing the left eye while aiming or of learning to shoot with the left hand. Closing the left eye would be preferable unless one were left-handed. To determine the master eye, extend fully the right arm and index finger. Keeping both eyes open, carefully align the top of the finger with a small object some distance away. Without moving the head, close the left eye and if the sight alignment between eye, finger and object appear the same as with both eyes open the right eye is the master eye. If the finger appears to point to the left of the object then the left eye is the master eye.

Trigger squeeze is all-important with the pistol and its effect much greater than in rifle and shotgun shooting. One may be able to pull the trigger of a shoulder gun without deranging the aim, as such weapons are firmly supported by the shoulder, arms and hands, whereas the slightest movement of a pistol trigger finger has a tendency to cause an unsteadiness in the balance of the pistol and a corresponding movement of the line of sight. Too much emphasis cannot be placed on the necessity for care in learning trigger squeeze and on this one detail endless time can be spent. To the artist skillful with pencil or brush or more particularly the clever surgeon schooled in the accurate use of delicate instruments the necessity of smoothness and accuracy in releasing a hammer by proper trigger squeeze is at once evident and a realization by them of the care required in this operation may account for the fact that in the ranks of the pistol shooters are found a large percentage of men of the medical profession. Until a person can squeeze his trigger without deranging his aim while the hammer falls, he should confine his work to snapping practice and his ultimate success and progress will be in proportion to his efforts spent in solving this problem. Pressing on a trigger in any direction except straight to the rear causes a deflection of the muzzle and a corresponding disalignment of aim. Suddenly jerking or pulling a pistol trigger has ruined many a good score and lost many a close competition. The trigger should be squeezed with that part of the trigger finger which rests naturally on the trigger when the weapon is properly seated in the hand and the squeezing should be done only with the trigger finger and not with the whole hand.

In connection with trigger squeeze it might be well at this point to caution the beginner against desiring too light a trigger pull until he has become reasonably expert with the pistol. A very light trigger pull for an untrained trigger finger is conducive to flinching—than which there is no greater obstacle to progress. A good clean pull of not less than 4½ to 5 pounds is plenty light enough especially on a straight pull automatic pistol.

Too little emphasis has been placed on "calling the shot" in pistol shooting. While it is essential that we aim correctly, hold steadily and squeeze properly, a correct performance of these operations will be of little value if we neglect the fourth essential. The greatest obstacle the novice has to overcome when he begins firing is that of flinching. He will soon learn to aim, squeeze and hold well enough to make respectable scores, but will find that he repeatedly pulls wild shots, because he flinches. *More annoyance, discouragement and failures in pistol shooting can be blamed to flinching than all other elements of the game.* If it was possible for a man to put out of his mind all thoughts of what is going to happen when the hammer falls or if it was possible for him to become absolutely mechanical in the technique of firing he would then be able to eliminate flinching or at least to so minimize the tendency that he would have little to fear from that source. Anything that can be done to accomplish this result is an aid to shooting and for this reason alone "calling the shot" is very important. In addition to assuring a shooter that he knows exactly what he is doing at every instant of the time spent in getting a shot away correctly, the concentration required in closely watching to see where his sights are aligned at the instant the explosion blots out the picture, causes him to forget the reaction that will occur when the hammer falls; consequently if he flinches at all it will then be after the bullet has left the barrel and no harm will be done. After the shooter has taken his position, aligned his sights, held his breath, and begun squeezing he should put out of his mind everything except calling the shot until the piece fires and if he does this he will soon find that his flinches become fewer and his scores are greatly improved.

To the novice the problem of holding appears the most difficult of the four essentials to master. With muscles and nerves untrained in the art of steady holding one finds that the muzzle of a pistol fully extended by the shooting arm does everything but remain coincident with the line of sight from eye to target. There is only one way to overcome this unsteadiness and that is by continual conscientious practice. Reducing this tendency of the pistol to move erratically across and around the bullseye will call for the exercise of all the

patience and self-control the beginner possesses. He must not expect to be able to train his muscles in a day or a week, but must approach his work in holding with the idea of slowly improving and keep in mind that good scores can be made with an unsteady pistol provided he gets his shot off with a smooth trigger squeeze at the time when his sights appear properly aligned with the target. Close observation of some excellent shots will show that they seem to have a very unsteady muzzle while aiming and squeezing and yet shoot fine scores. The beginner should remember that a movement of the shooting arm parallel to the line of fire, can be considerable and still not get the shot out of the "8" ring, but an appreciable angular movement of the muzzle from the line of fire gives a wide shot. The best results in holding will be obtained if practice is conducted after a period of rest. A few minutes of relaxation spent in quietly sitting down between practice scores, while snapping or shooting will have a noticeable quieting effect if properly utilized. On the other hand, physical activity such as running, rapid walking or similar exercise just before practice will increase the pulse and consequently the unsteadiness. Slow, deep breathing between shots or scores has also a quieting effect on the pulse. One should keep constantly before oneself the knowledge that unsteady nerves and muscles are capable of a vast amount of training and the effort to train them makes the game worth while. There will come days on which the barrel appears to "lay in a groove" for the shooter and if he has mastered his trigger squeeze so he is able to get his shots off during these perceptible periods free from movement he will be astonished at his scores. When after more or less careful practice and perseverance one is able to shoot well enough to qualify as an Expert Pistol Shot over the Army Dismounted Course without any uncertainty, then pistol shooting becomes a real pleasure and enthusiasm for the game grows by leaps and bounds. It is then that one begins to look around for other worlds to conquer and this usually takes the form of specialization in one or more of the different styles of shooting in which there is keen competition for supremacy among pistol shots. The thrill of competition shooting with all its ups and downs gets into the blood of the enthusiast, the acquisition and possession of especially fine weapons for the different phases of the game is a source of endless pleasure while the satisfaction that comes from the knowledge of success gained in an undertaking as difficult as learning the Art of Pistol Shooting is the greatest reward of all. It is then that we are able to appreciate the words of one of our shooting philosophers who says: "Once a shooting man, always a shooting man, never changing, never losing interest and never growing old."

Problems of an Officer on National Guard Duty

By Major H. A. Bagg, C. A. C.

HAVING been requested to furnish an article on National Guard duty of today, I shall attempt to give a few points which may aid those who eventually will be detailed on this work.

When an officer arrives at his station and reports, one of his first question is "What are my duties?" The answer is often, "Your armory is located so and so. Find out when the unit holds drill; get acquainted with the officers with whom you are to be associated; read over the circulars and orders—then start instructing." This he does to the best of his ability, and probably flounders around for the first few months not knowing where or to whom to turn. The reason for this being that his entire mode of life has been changed. Instead of following a schedule of drill and instruction, having his battery to work with daily, he finds that in the National Guard he sees the men not to exceed two nights a week and then for about two hours.

The normal officer on National Guard detail for the first time is prone to suggest a more or less complete reorganization; and proceeds to lay out a comprehensive schedule for drill and instruction, including school work for officers and non-commissioned officers. Having plenty of time himself, he generally plans about triple the amount of work the Guard officer can be expected to accomplish. When he finds that his ideas and schedules are not being followed, he commences to be discouraged. Unless he sees daylight soon, he thinks he is not getting cooperation; that the Guard is not in sympathy with his ideas; or that they are bucking him.

Here is where the trouble lies: he forgets that these men are earning their living, and are not able to devote much time to the work, while he, full of pep, is earning his living in his line, and can devote all of his time to it.

Let us look at the normal National Guard officer and try to analyze what can be expected of him. Then let us try to arrange schedules to fit the conditions; remembering that the officers can become discouraged, as well as yourself, by being assigned more than they can accomplish.

First—He is in a business which requires most of his time if he is to be a success.

Second—He attends drill one night a week.

Third—He attends school one night a week.

Fourth—His business may require one night a week.

Fifth—He probably belongs to a club or lodge which requires one night a week.

Sixth—He is probably married, and the above takes him away four nights a week, two of which are in connection with the Guard. Now, if you try to require him to devote another night to reading or studying on National Guard work, it will leave him but two nights to spend with his family, one of them being Sunday. His family naturally protests that the Guard occupies most of his spare time; so in order to save his home from disruption, he leaves the Guard.

Put yourself in his position. How many nights a week would you devote to the work? Looking at it from a reasonable standpoint, I doubt if anyone would say that a man should be required to devote over two nights a week. Of course there are those who can and do devote more time than this. Therefore, when planning schedules and school work, keep the above in mind.

After reporting for duty and getting acquainted with the officers of the organization to which you are assigned, the first and paramount duty to be performed is to gain the confidence of the officers, particularly the *Commanding Officer*. Naturally for a time you are on trial, so to speak, and until you can gain the complete confidence of those with whom you are to work, the road will be mostly up hill.

One must keep in mind that he is *not in command;* your work is supervisory only. You can recommend, suggest and advise, but you cannot *order*.

Many things will go wrong and patience, plenty of it, is needed. The standard sought is that of an efficient Regular Army unit, nevertheless due allowances must be made for the obstacles that must be encountered, and the two cannot be measured by the same ruler. Take the finest unit you ever saw in the Regular Army and consider what it would be like if assembled and drilled only once a week, and then but for one and on-half hours. After trying to picture just how this unit would function, then rate the organization to which you are assigned and see if they do not show up as well as could be expected.

Another thing which enters into the Guard problem, making it impossible to write instructions for the instructors, is this. Conditions in every locality are different, even within the same state. You may feel that the attendance in the organization where assigned is so poor that it seems almost hopeless; while organizations elsewhere in

the state are having good attendance. You wonder why? The reason may be that you are in a large city where there are many diversions. The other organizations may be in small localities where entertainment centers around the Guard and the armory. I remember talking to a major of a battalion stationed in a small place and comparing the attendance of the two units (the one I am with is in Chicago). His remark may bring enlightenment. "In case our men do not come to drill we can go down Main street and pick them all up in fifteen minutes." Can you picture a battalion commander going through Chicago and picking up his men in fifteen minutes or even fifteen days?

A battery commander has his troubles, but he is usually willing to go ahead. You will soon find that the battery commander's troubles are also yours. Once you can make *him* see that this is true, you start gaining ground. He may come to you for suggestions or advice after he has failed to accomplish a certain thing. You may suggest trying something else. It fails. You suggest another method with the same result, failure. The battery commander is looking to you for help. Do not his troubles become yours? They certainly do.

Naturally, after trying various methods, if you give up, everything is lost. You must continue until the desired results are finally obtained, remembering that you have more time to study out solutions than he has. Whatever you suggest, see that the plan is simple and easy of execution. A complicated, detailed plan will surely fail,

The guard is still undergoing development, which will continue for at least two more years. Problems, hard to solve now, will become easier later, particularly recruiting.

All officers are supposed to be in sympathy with the plan of National Defense as prescribed, but with an officer on National Guard duty it is absolutely necessary that you be wholly so.. Prior to going on detail an officer may not have had time to *carefully* study it. You must *study* this act, and if after having done so you still feel that you cannot bring yourself to believe in it absolutely, and work to the desired end—get off National Guard duty as soon as possible, for you will not succeed.

During your tour of duty, there may arise strife within the organization. If this unfortunate condition comes—*you must stay neutral.* It may be very difficult, and you may feel that by throwing your influence to one side or the other you will help matters. Generally all you will do is work your way into an embarrassing position, and accomplish nothing.

The National Guard regulations expressly prohibit instructors from interfering in local politics or becoming mixed up in internal discussions of an organization; some have disregarded these instructions with disastrous results to themselves and resulting in complications at their stations. Be careful that you do not become one of them.

One of the greatest problems of the Guard today (particularly in large cities) is attendance. An instructor, after reading the various circulars, and knowing the desires of the Militia Bureau on progressive schedules of instruction, correspondence schools, etc., is prone to lay out a system of drills for from six months to a year, progressing month by month. He will spend hours of hard conscientious work upon the schedules, and when they are finished he will be highly pleased with the fruits of his labors—until he starts to put them into execution. In a few months he commences to weaken. Why? On account of attendance. Starting with his schedules there may be 30 per cent of the command present for the first drill and 30 per cent for the next, but they will be a different 30 per cent from those present the first night, with the exception of a few who attend regularly. Therefore, the ones taking the second night's instruction are totally ignorant of what took place the first night. The third night a different 30 per cent may attend and so on, so that out of his first month's schedule, each man may get from 40 to 50 per cent of the work. By the end of three months his progressive schedule is completely snowed under. Naturally it is discouraging, but who is to blame? Is the battery commander, the battalion commander, the regimental commander or the instructor? Not one of them is to blame; it is simply a condition which exists, and that all must face.

At first many thought their troubles of enlistments and attendance would cease if ex-service men could be recruited for the backbone of their batteries. How sad has been the awakening, at least in Chicago. Surely, they will join, but that is all. They served in France or in the United States and know more about the game than General Pershing himself. Therefore, they do not attend drill because they do not need it. Do not take this to mean all of them, for there are those in this organization now who are and would be a credit to any organization, and who are working hard for the success of their unit.

Nothing is more discouraging to men who come to drill, than to do the same thing time after time in order that those who come occasionally may receive the fundamentals. I am convinced that the battery commander can work out a solution to this, with the aid

of the regimental commander and the instructor. This could be done by dividing up the batteries, letting those who attend more or less regularly go ahead, and drilling those who come irregularly by themselves. This has been suggested before and works out better on paper than in practice. For example, I have seen where two and even three batteries would have to be combined for infantry drill in order to have a command larger than a platoon. This condition would continue to exist for several weeks. In each of these batteries there would be two or three men who happened to drop in to see if the command had ceased to exist due to their absence, while the others present had been attending regularly. To carry out the above suggestion it would be necessary to drill these two or three men separately.

When it came time for camp, or a call for riot duty, the command turned out with better than 60 per cent of the maintenance strength with little or no last minute recruiting. This may sound a little discouraging, but it is not meant that way. Instead it is to show the conditions as they are.

As these conditions do actually exist in the field, it can readily be seen that instructors cannot be tied down with ironclad regulations as to what they will do day by day and hour by hour. Instead each must work out his own problems as they present themselves, and they will often be very dissimilar.

An instructor will not be on the detail very long before the subject of *pay* will begin to haunt him; he will know that something is wrong but will not be able to put his finger on it. The trouble lies with the *percentage basis.* A man should be paid for each drill attended. It is understood that the Militia Bureau now has this matter under advisement.

In closing, there are a few *don'ts* that should be added which may be of some help for those detailed for the first time.

Don't try to bluff, it will not work. If you cannot answer a question offhand say so, look it up and then give the correct information. Two or three wrong answers and you are lost.

Don't attempt to assume command of the organization. You are not in command, you are there as an instructor and advisor, to help as much as you can, but not to give orders.

Don't expect too much. Remember the men you are working with are not earning their living through the National Guard work.

Don't lay out so much work that it cannot be done, except by devoting to it an unreasonable amount of time. Not only will it not be done, but the officers will become discouraged.

Don't criticize; if corrections are to be made do so in a constructive way so that no one will feel personal criticism for mistakes. You will find those who are prone to take offense, even when you are merely trying to correct an error.

Don't advise changes unless you can suggest a better way. In other words, do not stop something being done, leaving a *hole* not replaced by a better idea.

Don't make anything complicated. Simplify everything to the utmost.

Don't let anyone know you are discouraged, no matter how hard the road is. Remember if you are discouraged, the officers of the unit are also. If they think that you are giving up hope, they will certainly throw up both hands and quit.

Don't think that you need not be close to the organization. Affiliate yourself with it, work with it, and for it. If it progresses be happy. If it has its downs, do not be indifferent about it. Try to let it become a part of yourself.

"We do not know from what source or in what manner pressure may be brought against us. But it is certain that to remain weak and unprepared in the face of such a situation is to invite aggression. It is, moreover, essential not only that we maintain a reasonable state of preparedness, but that it should be a matter of international knowledge that we are so prepared."—*Secretary Weeks.*

Organized Reserve Duty

By Captain M. E. Barker, C. A. C.

THE act approved June 4, 1920, created a real military policy for the United States. It brought the Organized Reserves into being as an organic part of the United States Army. This act provided for supervision of the duties of all components being carried on by personnel of the Regular Army. The nature of this duty varies from time to time and place to place. This paper is prepared with the hope that some of the suggestions contained herein may be of use to others upon entering the duties of Executive officer for organizations of the Organized Reserves. The suggestions offered are from a variety of sources.

Very little has been published on the duties of a Regular Army officer who has been detailed for duty with an organization of the Reserves. Very likely he will be sent into a town in which he is unacquainted. He then has the double task of taking care of his family and getting his work started. The first step advised when one reasonably expects to go on this type of duty is to consult some officer who has had experience in the work. In addition the following regulations should be religiously studied: Army Reorganization Act, Approved June 4, 1920 (H. R. 12775 of the 66th Congress) Special Regulations No. 48; Special Regulations No. 43; Special Regulations No .44b (and pertinent changes in Army Regulations). The officer going on this duty should provide himself with a complete set of Training Regulations, Special Regulations and Army Regulations.

Upon arrival at the new station he will find no Quartermaster to call upon for the purpose of transporting his household goods from the station to his new home. In fact, he will probably not have a suitable house within a month after his arrival. However, have the drayman sign a Public Voucher, Form No. 330 Treasury Department, and three copies of the bill on which is a certificate that the claim is just and that payment therefor has not been received, and send the bill to the proper Finance Officer for payment. The many services performed by the Quartermaster and the prisoners on a Post will be missing, so it is well to provide oneself with some carpenter tools and a good suit of fatigue clothing, for they will come in very handy on many occasions. Unless an officer is well acquainted

in a town, he will do well to go slow in selecting a home, for real estate dealers everywhere are pretty much alike.

The military duties of the Executive are important, but his duties as a "good will" representative of the Army in the vicinity of his station are equally as important. He is the link which connects the War Department with the Reserve officer in civil life. He must supply the personal touch. Without the personal touch, the entire system will fall through. Any large business house realizes this in its relations with its dealers throughout the country. Its representatives call on its dealers and supply the personal link binding the dealer with the great organization. The Executive Officer fills this place between the War Department and the individual Reserve Officer. Therefore, of necessity, the successful Executive Officer must be interested in *people* as well as tactics and drills. He must be able to go to the lawyer's office and discuss the principal legal cases in the community and into the Engineer's office and talk building and engineering developments. My impression is that a large per cent of the Coast Artillery Reserve officers are engaged in these two professions. However, they are given only as illustrations.

The military duties of the Executive fall into two classes, viz.: (a) Those required by higher authority; and (b) those voluntarily engaged in by the executive. Under (a) may be mentioned:

1. About three months' duty each summer at training camps.
2. Carrying on correspondence courses during about eight months of the year.
3. Recruiting the officer personnel of the Reserves.
4. Recruiting the enlisted personnel of the Reserves.
5. Recruiting for the C. M. T. C.
6. Compilation of all possible data pertaining to the facilities available for mobilization and training of the various units under his jurisdiction in the vicinity of the home of the unit.
7. Collection of data pertaining to the qualification of various members of the Reserves under his jurisdiction.
8. Sitting as a member of Boards for appointment and promotions in the Reserves.
9. Supervising mobilization plans by unit commanders.
10. Studying or conducting courses of instruction for Regular Army personnel.
11. Miscellaneous duties according to the occasion.

Under (b) may be mentioned several things that do not seem to be of especial importance along military lines, yet the Executive has to watch a large number of things not ordinarily included in company duty. The thing that an officer has to watch in extending

his work beyond the recognized boundaries is the local color. The local situation must be carefully studied and the Executive should at all times be in close touch with all the activities of the community. Some of the things which he may do are enumerated below.

1. Start the organization of Rifle Clubs in his area.

2. Instruct various police departments and rifle clubs in marksmanship.

3. Become a Scoutmaster in the Boy Scouts.

4. Become a member of the Chamber of Commerce in the town.

5. Become a member of at least one civic organization such as the Rotarians or Kiwanians.

6. Become a member of one recognized high grade society such as the Masons or Elks.

7. Give some military instruction in the local high schools if requested to do so—and see that you get such a request.

8. Write occasional articles for the local press. Make them interesting, and put over your ideas without seeming to teach.

9. Cooperate with every agency that will let you get a start.

10. In other words, sell the Army of the United States to the people.

Beside the military duties that the Executive handles he will find time for some social activities. In his social activities he is very closely watched. People will generally go out of their way to criticize an Army officer. Whether he is in uniform or not, he is a marked man. A lot of people are watching his every move, whether he knows it or not. Hence he must watch every move he makes most closely, for his private life establishes his reputation in the community. Whether he cares for the local color or not, he must recognize that local traditions are somewhat sacred, and so regulate his conduct and activities.

Opportunity for service in work connected with the Organized Reserves is very great at present. There is some time for study and general cultural activities. There is time for amusements, and it is most profitable for an officer to excel in some line of sport, such as tennis, golf or shooting. Such excellence gives entry into many activities not otherwise open. There is perhaps no other work in the Army where a man is so thrown upon his own as in this work. He is largely his own boss. He makes his own job. But if he wills, he can fill every day with a full twenty-four hours of work. If he can't demonstrate initiative, energy and efficiency as outlined above, he cannot hope for a rating of "average" on his efficiency report.

Coast Artillery Prospects

By 1st Lieutenant B. F. Fellers, C. A. C.

THE degree of rapidity in which our famous old Coast Artillery forts are being either put out of commission or turned over to other branches of the service is alarming. Reduction of the Army, War Department policy and progress all have played a part in this radical change. Experienced officers, excellent Coast Artillerymen, are wondering and asking, where will it end? What is to be our future?

There are certain features in the defense of our coast line, harbors and cities which, as a result of the World War, must be materially changed. Long range firing is no longer an experiment. It is an actuality. The battle of Jutland began and was fought at a range greater than that of most of our coast defense guns. Batteries are no longer safe from enemy naval vessels because they lie securely hidden behind huge concrete emplacements. The bombing off the Virginia capes, the successful flights of the *Barling* bomber, and the *Shenandoah* have all shown how futile it may be to depend on guns unprotected from air attack. In order that we may meet these new conditions which have arisen during the last ten years we must endeavor to advance along the following lines:

1. Mobile Artillery, (a) tractor drawn artillery, (b) antiaircraft artillery and (c) railway artillery.
2. Experimentation work in (a) new range finding apparatus, (b) searchlights, (c) radio, (d) long range firing, (e) night firing.
3. Cooperation with the Air Service.
4. Supply of the necessary technically trained personnel.

The advantages of mobile artillery are manifold. The importance of being able to concentrate quickly heavy guns along our vast coast line in case of a concerted attack cannot be overestimated. Future wars, if successful, will by necessity be offensive wars. In this case we must have well trained and equipped mobile units to lay down interdiction fire along the enemy arteries of supply. Our superb railway systems are particularly well equipped to transport heavy guns, in fact much better equipped than those in any foreign country. Railway mounts may be quickly drawn across the continent on at least four different routes.

The question of security also enters into the argument. Upon the declaration of war, the enemy will have our fixed artillery definitely located, while if he begins to shell a mobile battery, a new position may be taken up before serious damage results. The question of high finance and government economy also enters. It will be less expensive to follow up progressive ideas with new designs if they do not have to be placed in enormous concrete emplacements, prohibitive in cost. Horizontal base lines, so accurately measured and oriented for fixed artillery, cannot of course be so successfully employed with mobile guns. But there is some question as to the dependability of this method in the future. Long ranges are going to force aerial observation. This is coming; there is no use to argue against it; the day when a battery commander must control his fire from the air is near at hand. The development and use of mobile and antiaircraft is in its infancy. Antiaircraft development must keep up with pursuit flying and that is setting a fast pace for antiaircraft work. Every rail and manufacturing center, every harbor, fortification and city of consequence, must have antiaircraft protection. We may not score many hits on enemy pursuit and bombing planes, but we can manage to embarrass any pilot who ventures to fly too low. But our work with mobile artillery must be closely accompanied by progressive experimentation in subjects related thereto.

Our work in sub-aqueous range finding is promising. We are equipped and fitted to carry on this intensely interesting work. It should be and is being rightly encouraged. Radio, about which we are learning more and more each day, may offer flattering possibilities in range finding. Our searchlights are perhaps second to none, yet their development has for some time been at a standstill. Long range firing should be the order of procedure at all our target practices; sinuous courses with targets at various speeds ranging from thirty knots to almost a standstill should be attempted. In other words, our experimentation should usually follow war time conditions and not always the ideal conditions experienced at our present target practices. Practices conducted during ideal conditions at an objective traveling eight knots an hour, on a straight course, may be valuable to teach adjustment and "home ram"; they may be of value to test powder and material; but as a simulation of conditions we will be forced to face in the event of hostilities, they are absurd. More frequent night firing would result in interesting problems with range finding apparatus, pyrotechnics, searchlights, radio, the Air Service and the Navy.

The Air Service and the Coast Artillery are inseparable. The reputation and future success of both branches depends in a large measure on one another. Without Air Service the Artillery is lost. Without cooperation with Artillery the "observation" division of the Air Service degenerates considerably. To one who has observed long range target practices from the air, there is no question that this observation is second to none yet devised; to those who have observed from the ground only, there may be some doubt as to the accuracy of aerial observation. However, a careful analysis of practices and a comparison of aerial and terrestrial observations with those of the camera, gives the advantage to the aerial observers. Our branch in its future work is so closely allied to the Air Service that cooperation with them must be complete; so complete that each Coast Artillery District should have air observation and pursuit units assigned to it, not necessarily under the District Commander, but *detailed* on artillery work. We of the artillery should, on the other hand, require a substantial percentage of the younger officers to serve a detail in the Air Service for a period sufficiently long to train them as observers and emergency pilots. This plan would serve a twofold purpose; we would have good observers from the standpoint of an artilleryman, and the friendly relationship thus established would facilitate the necessary cooperation. The pilot and observer must not only be acquaintances, but should be the best of friends, in order to have the proper amount of confidence in one another. The Air Service, working in conjunction with the Artillery, has recently demonstrated its ability to determine range and azimuth of targets at extreme ranges and invisible from terrestrial observation at the battery. They have even gone a step further and successfully transmitted data accurately enough to enable the battery to obtain hits on a target moving at ranges beyond the horizon. In the future we may reasonably expect artillery officers to designate targets, fire batteries, control fire and make adjustments from the air. If the enemy lays down a smoke screen over the water, our only hope lies in information from aerial observers.

Perhaps no branch of the service demands as much of its personnel as does the Coast Artillery. A well trained artillery officer must have a fair knowledge of all the other branches; he must have considerable knowledge of radio, chemistry, sound and light, power, motor transportation, civil and electrical engineering, navigation and meteorology; and he must have a thorough, definite and comprehensive knowledge of telephones, submarine mines, artillery and all its many ramifications, fire control, adjustment, field fortifications, and orientation. To supply this necessary technically trained

personnel, the Coast Artillery must look to the graduates of the leading technical institutions of our country. Graduates of these institutions are going to lend their invaluable skill in solving our problems. They are going to cooperate wit the Regular Army officers in the improvement of our methods and in the development of new ideas. The men who today are undergraduates of our technical schools will tomorrow be the leading engineers, designers and constructionists of our nation. The interest we arouse in these men will be passed on into the community in which they labor. And the interest is already there in institutions where we have our R. O. T. C. units. The writer recently made a short talk, on fire adjustment from the air, to some of our students at the Massachusetts Institute of Technology. He was surprised at the number of questions asked, at the keen attention and interest displayed, and extremely embarrassed in attempting to answer some of the questions fired at him. These young men are the salt of the earth; they are wide-awake, keen, alert, ambitious and resourceful. They are just the type we want and must have in our Artillery Officers' Reserve Corps.

Several of these men have been known to confide with Regular Army officers that they could understand no one who would by choice take up any branch other than the heavy artillery. We are gifted with an arm which offers every advantage to a young technically trained officer. It is just as much our duty to associate with the civilians and R. O. T. C. men, to preach to them the meaning of our National Defense Act, and the merits of the Coast Artillery Corps, as it is to be on time at drill. The officer today who sticks to his post, who sees only Regular Army people, no matter how hard he works at his task, falls short of his mission. We are the liaison between the National Defense Act and the civilian population, and our weapon is the mission of the Coast Artillery Corps. Were the business men of the coastal states accurately informed on the present defenseless condition of our coast lines, it is doubtful if they would sit quietly by. We have a great deal to tell them; it is part of our work. Future wars are going to bring the enemy to our shores. In this event, we become the first line of defense, other arms must and will gather around us for aid and support; we must not fail them.

Our salvation then lies in a progressive evolution based upon our rich heritage of the past and present. Our policy must be progressive. Should we be more careful to preserve the old shell than we are to foster the living germ, our neglect will be fatal.

EDITORIAL

General John J. Pershing

THE Army's most distinguished soldier and one of the greatest military leaders known to American history retires from active service this month. General Pershing's life is another portrayal of American democracy. Born of humble parents near a frontier town, but in a country where everyone has an equal opportunity for advancement, he reached the supreme height of greatness. Graduated from the Military Academy in 1886, he was twenty years later, for distinguished service, promoted from the grade of Captain to that of Brigadier General. In 1917 he was selected to command the American forces in France and shortly after the end of the war was appointed General of the Armies of the United States. He has been honored with the Distinguished Service Medal, the Thanks of Congress and Honorary Degrees from many universities. In addition, all the Allied powers in appreciation of his great work during the war have bestowed upon him every honor.

In France, where his great reputation was made, he quickly grasped with clear-sighted vision, that if the Allied cause was to be saved from complete disaster, America's help must be prompt and powerful. It was his urgent representation of the situation that brought the realization to this country of the desperateness of the Allied cause, and made clear the fact that it was men and not dollars that must be quickly forthcoming if the Central Powers were to be denied victory. America's reaction to General Pershing's representation of the situation gave new life to war-wearied and discouraged France and England and enabled them to weather through the dark days of 1917. Had General Pershing acceded to the plan of the Allies, the American units as soon as formed would have been absorbed by the larger units of France and England and their individuality lost. Foreseeing such a situation, he insisted that the American Army be treated as those of Belgium, France and England and they, too, be assigned a particular part of the frontier. As a consequence, we have to the glory of American arms the distinctly American victory of St. Mihiel and a large part in the decisive battle of the Meuse-Argonne.

Although he will always be best remembered for his distinguished service during the World War, he has probably rendered just as great a service to the country since that time in having established a sound military policy—the only one the country has ever had—a policy that if followed, will in the future prevent the wastage, uncertainty of victory, vacillation and inefficiency that have always gone hand in hand with all the wars in which this country has been engaged. With the National Defense Act as a basis upon which to work, he established an efficient General Staff; built up a sound educational policy within the Regular Army; so encouraged the National Guard that it has become a powerful weapon in our first line of defense; created the Organized Reserves; made of our Citizens Military Training Camps one of the country's most popular institutions; and last, and largely by his own personal efforts in never missing an opportunity to address assemblages on the subject of National Defense, he has so educated the people of this country, that today they are beginning to have a clear conception of the meaning, needs and necessity of a sound military policy.

It is gratifying to know that General Pershing is retired from active service not because of physical disability, but because of the requirement of law that does not permit an Army officer to remain on active duty after reaching 64 years of age. He still appears in the prime of life, physically active, and young in spirit. There is every reason to believe that for many years to come he will exert a powerful influence in keeping alive in the minds of his countrymen the necessity for constant vigilance and preparation if this country is to continue to live in peace and prosperity.

Variety of Service

Once upon a time there was an enthusiastic Coast Artillery captain who had previously commanded a certain battery of 6-inch disappearing guns. For years thereafter, in the club, on the harbor boat, at officers' call, and elsewhere, he would regale every helpless audience with an enthusiastic rehearsal of what those guns would accomplish at his bidding. The least these guns would do was to eat out of the battery commander's hand. Under the circumstances, what wonder that our ardent captain counted every day lost that was not spent in the company of the 6-inch D. C.!

There is another earnest Coast Artilleryman who has been a booster for Railway Artillery since the days before there was any Railway Artillery. To him there is no comfort in a gun without an M. C. B. coupler.

Then we know a Tractor Artilleryman whose heart sinks at the prospect of his ever again being bolted to the concrete.

Probably every officer serving with an Antiaircraft outfit shares the inner conviction that the real future of the Coast Artillery is in the air.

And there is the vivid memory of the keen, lean face of a young Coast Artillery officer, lighted by the rays of the afternoon sun, streaming through the clouds over the shoulder of Mariveles, while he poised on the bridge of a Planter, reeling to a free tide and the sweeping monsoon. And the significance of this memory is that a mine command is just the finest place to be in the Coast Artillery service.

All these enthusiasms are splendid. But the justifying keynote of our enthusiasms should be inclusive and not exclusive. The attractiveness of Coast Artillery service lies in its variety, in its challenge to learn ever something new, in its freedom from circumscription to a limited field, and withal, in its loyalty to an artillery unity, whose characteristic is a mental alertness which does not balk at the application of fundamental principles to most diverse conditions.

So it is that variety of service is a broadening influence in our lives, and should be welcomed and not deplored. There are certain assignments, such as to the National Guard and R. O. T. C. duty, where a Coast Artillery officer must be prepared to pass out information on short notice on the details of every variety of our technique. So it is that a Coast Artilleryman must always be on his toes, must always "keep coming." Thus is stagnation interdicted, and the very variety of our service is alike the challenge and the privilege of the Coast Artillery.

The Price of Unpreparedness

During the recent sessions of the American Iron and Steel Institute at New York, 275 members visited the Aberdeen Proving Ground, about twenty-six miles from Baltimore, in order to see with their own eyes what the United States is doing in the development of heavy guns and other ordnance. Before introducing the President of the Institute, Judge Gary, Benedict Crowell, President of the Army Ordnance Association, read a statement which contained the following words: "The Central Powers mobilized 22,850,000 men and inflicted 22,090,000 casualties on the troops of the Allied Powers. The Allied and Associated Powers mobilized 42,189,444 men and inflicted 15,405,000 casualties on the Central Powers—the price of unpreparedness."

America at Work believes that war between nations is on its way to extinction. We believe this, not as a sheer act of faith, but simply as an inference from changes in human habits which have already taken place. The passing of private vengeance and of the necessity for the special protection of persons and property against violence in great centers of civilization is—historically considered—but as of yesterday. Its prophecy 500 years ago would have seemed as much a flash of pure imagination as the prophecy today that war between nations will pass also.

But holding that war as an institution is doomed, we desire to emphasize with all our power the colossal folly of national unpreparedness—a folly emphasized not only in the succinct statement just quoted, but also in the entire military history of the United States. The needless waste of the lives of our young men through the unpreparedness of the Government in every war from the Revolution on is a national shame and a national disgrace. * * * *

The United States is not a warlike nation. In this respect the national ideal cannot be changed. There is no danger of "progressive militarism" here. *America at Work* sees no possible war cloud in the present skies; the talk about the possibility of war with Japan is political nonsense and economic nonsense as well. But no American saw a war cloud on the horizon on July 1, 1914—and what we now wish to protest against is the senseless, criminal sacrifice of American boys on the worthless altar of military unpreparedness which took place in 1776, in 1812, in the early '60s, in 1898, and again in 1917-1918.

Cannot we, for the sake of the mothers and sons of America, take counsel with ourselves in time of peace and be prepared to economize precious economic resources and infinitely more precious human lives in the hour of need? Or in the face of the fact that since July 4, 1776, we have been engaged in a major war five times, or once in twenty-five years on the average, are we to continue blind to our record and deaf to the voices of the past?

Editor's Note: The above editorial, "The Price of Unpreparedness," is reprinted by permission from *America at Work.*

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, *Col., C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of July

Project No. 246, McNair Board Powers and Limitations of Coast Artillery and Air Service.)—Under instructions from the Adjutant General of the Army a board of officers was convened in the Hawaiian Department to investigate, consider and report on the powers, limitations and combined training of Coast Artillery Corps and Air Service in coast defense. Specifically, answers as conclusive as possible, were desired to the following questions:

(a) Within what vertical range can aircraft approach coast defenses armed with the latest existing antiaircraft devices for the purpose of bombing without being subjected to effective fire?

(b) Can aircraft bombing at an altitude beyond the effective range of existing antiaircraft devices put out of action coast defenses to the point where they will not be able to effectively function against an enemy fleet?

(c) At what range can bombing aircraft begin to economically and efficiently replace existing large caliber Coast Artillery guns against an enemy fleet or other target?

The report of the board has been received by the Coast Artillery Board and a joint study thereof is being undertaken in cooperation with the Air Service at Langley Field.

Project No. 247, Test of Siebert A. A. Mount for Machine Guns.—Lieutenant Colonel Kenneth C. Siebert of the 202nd Coast Artillery (A. A.) Illinois National Guard, has designed an antiaircraft mount for machine guns which will be tested by the Coast Artillery Board upon the arrival of Colonel Siebert in September.

Project No. 248, Method of Adapting the Artillery Meteorological Message to the Wind Component Indicator.—It has come to the attention of the Coast Artillery Board that the practice followed in the Coast Artillery in the matter of stating the direction of the wind in the Meteorological Message is not uniform. The Air Service Meteorological Message provides for 72 points to the circle and zero north, and this system of units and azimuth origin would serve for Coast Artillery, although the south azimuth origin would be more satisfactory. The particular system of units and the specific azimuth origin used is not important, but whatever system and origin is decided upon should be uniform throughout the service and announced in orders. The Board completed this study and made certain recommendations for adapting the artillery meteorological message to the wind component indicator which will be published at a later date.

Project No. 249, Firing Tables for 6-Inch Gun Firing 90-Pound Projectile at 2700 f.s. M. V.—In Item 3798, Ordnance Committee Minutes, it was recommended by the Ordnance Department that 6-inch guns use 90-lb. H. E.

shell as target practice projectiles. In 6-inch guns, Models 1900, 1903 and 1905, a charge to give 2600 f.s. velocity was recommended. In 6-inch guns, Models 1897 and 1908 a charge to give 2700 f.s. velocity was recommended. Firing tables are on file for the 90-lb. projectile fired at 2600 f.s. velocity, but none are on file for the 2700 f.s. velocity. It was requested that the Ordnance Department be asked to supply firing tables for the 2700 f.s. velocity.

Project No. 250, Test of Gun Cameras, Mark I and Mark III.—Two gun cameras have been received from the Air Service which will be tested to determine if they be of value in making a record of simulated machine gun fire against aircraft or actual artillery fire at towed aerial targets. The cameras are of different types, one taking but one exposure at a time and the other taking a continuous motion picture.

Project No. 251, Lubricating Oil for 25-K.W. Generating Sets.—In a letter to the Adjutant General of the Army, dated May 15, 1924, the commanding officer, Coast Defenses of San Francisco, reported the heavy motor oil, Specification 2-26-B, supplied by the Quartermaster Department as deficient as a lubricant for G. E. 25-k.w. gasoline electric generating sets, in the following respects:

(a) Its use causes increased wear on the bearings, necessitating frequent adjusting and overhauling.

(b) It causes increased pitting of valves and valve seats, necessitating frequent grinding, which shortens the life of valves and cylinders.

(c) The amount of oil consumed is more than double, by reason of the necessity of frequent renewals of the entire oil contents of the crank cases.

(d) It causes the engines to operate noisily and produces unsatisfactory speed regulation.

The above letter was referred to the Coast Artillery Board, July 1, 1924, for study and test to determine the characteristics of a satisfactory oil for use in 25-k.w. generating sets, and to ascertain whether there is a standard army specification available which covers it.

After a study of the matter the Board made the following comments and recommendations:

1. Prior to 1917 the lubricating oil supplied for the 25-k.w. sets was "N.F.O." gas engine cylinder oil, manufactured by the New York and New Jersey Lubricant Company of Newark, New Jersey. This oil has been, and is now, supplied by the Quartermaster Corps to the Coast Defenses of Long Island Sound, where continuous operation was had for more than 12 years. It has always been considered a satisfactory lubricating oil for 25-k.w. sets. Another oil suitable for these sets is "Gargoyle, D. T. E., Extra Heavy," manufactured by the Vacuum Oil Company of New York.

2. In the Coast Defenses of Chesapeake Bay lubricating oil for 25-k.w. sets supplied by the Quartermaster Corps has not proved satisfactory. The usual trouble has been that the "heavy" oil supplied is too light. This is practically the same trouble that has been encountered in the Coast Defenses of San Francisco.

3. Specifications No. 2-26C, June 18, 1924, U. S. Quartermaster Corps Specification, superseding No. 2-26B, lists five grades of lubricating oil heavier than "Heavy." The Board believes it likely that among those five heavy oils one will be found which has characteristics suitable for 25-k.w. sets.

4. In view of the fact that facilities for testing lubricating oils at Fort Monroe are limited and that, in any case, considerable time would be required to make a satisfactory test, the Board submitted the following recommendations:

a. That the Bureau of Standards be requested to make a test of Quartermaster Corps specimens of the five heaviest lubricating oils listed in Specifications No. 2-26C in comparison with specimens of "N. F. O." and "Gargoyle, D. T. E., Extra Heavy" oils, and that information be furnished as to which of these five oils most closely corresponds in its characteristics to the "N. F. O." and "Gargoyle."

b. That a test be made at Fort H. G. Wright, N. Y., of the oil, if any, found to correspond to "N. F. O." and "Gargoyle." This for the reason that the 25-k.w. sets at Fort Wright have for years been supplied with "N. F. O."

c. In the event that no oil listed in Specifications No. 2-26C be found to have the characteristics corresponding to "N. F. O." and "Gargoyle, D. T. E., Extra Heavy," that the Bureau of Standards be requested to draw up specifications for a suitable lubricating oil for the 25-k.w. sets based on the two oils known to be satisfactory and that pending the adoption of such specifications only "N. F. O." or "Gargoyle, D. T. E., Extra Heavy" oil be supplied for the use of the 25-k.w. sets.

Project No. 252, Modification of Altimeters and Gun Sights For Night Fire.—Past experience in the operation of antiaircraft searchlights has been such as to lead to the logical conclusion that night artillery fire at aerial targets must be by the method of "fire by sound"—that searchlights could not be relied on to illuminate a target for a sufficient length of time to enable fire thereon by normal daytime methods.

Present searchlight-airplane operations being carried out by the 61st Artillery (A.A.) in conjunction with night bombardment airplanes from Langley Field are so successful, from an antiaircraft viewpoint, that more consideration of night firing at illuminated airplanes is warranted.

It is evident that even should a single plane be illuminated the normal position finding system probably will be inoperative because of the irregular course which will be adopted by the aviator in an effort to escape from the beam. One of a formation so illuminated would, of course, be more or less restricted to a regular course because of the necessity for maintaining the formation.

Even should the course become irregular it is still possible and essential that fire be opened with estimated deflections. For such fire to be of any value the altitude, which is the basis of the determiation of fuze range, must be accurately determined. With an accurate altitude and a range indicator, gun type, the most effective night fire possible at a target flying an indeterminate course may be improvised.

Should the target escape from the beam the determination of its altitude while illuminated will be of great value in the continuation of the fire against unseen target whether by "fire by sound" or barrage methods.

It is apparent that the altimeter, type A, should be modified for night use, or at least that altimeters so modified should be tested to determine their utility and accuracy. It is further evident that any altimeter adopted to replace the type A should be designed for night as well as day service.

The gun sight should be designed for night use.

Because of the certainty that an irregular course will be adopted by the target upon illumination the necessity for modifying the remaining telescopes in the position finding instruments is not so clearly indicated.

The Board therefore recommended:

a. That one altimeter, type A, Model 1920, (two instruments) be modified so as to permit illumination of the cross hairs.

b. That one sight for the 3-inch Model 1918 A.A. gun be modified so as to permit illumination of the cross hairs.

c. That the materiel, modified as recommended be sent to the Coast Artillery Board for test.

Project No. 253, Canopy Tops—10-Ton Tractor.—The Ordnance Officer of the Panama Department reported that extensive repairs, and in some cases replacements, are necessary on the canopy tops of the 10-ton artillery tractors if the tops are to be retained in service. That due to the installation of the capstans on certain 10-ton tractors, it will be necessary to modify the canopy tops to prevent interferences and that considerable saving of money would be effected if the canopy tops of the 10-ton tractors were made obsolete.

This report was referred to the Board for comment and recommendation.

The Board made the following comments and recommendations:

a. The canopy top for the 10-ton tractor consists of a frame-work over the driver's seat supporting a canvas top and curtains with transparent windows.

b. In the opinion of the board the sole advantage to be derived from the use of a canopy top on a tractor is protection of the driver during inclement weather. Opposed to this are the following disadvantages:

(1) It impairs the driver's view of the road.

(2) It renders access to the motor somewhat difficult.

(3) It increases danger to the driver in case of accident.

(4) It is a fire hazard.

(5) It is of comparatively frail construction and hence, if used frequently, is constantly in need of repairs.

c. It is further the opinion of the Board that to supply tractor drivers with suitable clothing for protection against inclement weather is preferable to relying upon canopy tops for such protection.

d. The Board therefore recommended that canopy tops for 10-ton tractors be declared obsolete.

Project No. 254, Comments on Revision of Training Regulations No. 435-55, Analysis of Drill and Analysis and Report of Target Practice.—The Board recommended that the forms for Battery Target Practice Reports, pages 68 and 69, and Timekeepers Record for Battery Practice, page 60, be modified to show the following:

a. Elapsed time for trial or ranging shots; time allowed out, and the allowed net time for the trial or ranging shots.

b. Time between firing the last trial or ranging shot and the allowed net time of the series.

c. Elapsed time of a record series; time allowed out, and the allowed net time of the series.

d. Total elapsed time of the practice including trial fire; time allowed out together with reasons therefor, and the allowed net time of the practice.

The reasons for the above recommendations will be published in Coast Artillery Board Project No. 220, Coast Artillery Firing, which is now being prepared.

Project No. 255, Data Transmitter.—The Board has received from Frankford Arsenal for test a data transmitter and receiver. This is a device constructed on the principle of Wheatstone bridge. It will be given a thorough test at Fort Monroe in the near future.

Project No. 256, Cloke Plotting and Relocating Board For Long Range Batteries.—Majors G. M. Barnes and H. K. Rutherford, Ordnance

Department, conferred with the Coast Artillery Board in 1923, concerning the development of fire control devices for long range batteries. In the matter of a plotting board it was agreed that a design of the Standard Cloke Plotting and Relocating Board should be developed. Study drawings of the proposed Cloke Board for long range batteries was submitted to the Board for comment. The Board has completed the study and its report thereon will be published at a later date.

Previous Projects on Which Work Has Been Accomplished

Project No. 187, Meteorological Instruments For Antiaircraft Organizations—Determination of Effect of Distance Between Meteorological Stations on Data Obtained.—

Discussion: 1. The distribution of meteorological equipment to mobile artillery should be extended only to those units of sufficient size which operate at such distance from an established meteorological station that the values in the meteorological message do not apply. The limiting distance depends upon the type of terrain and the kind of artillery.

2. The formation of the ground affects meteorological conditions near the surface, although as the altitude increases the effects of the terrain usually decrease and there is a tendency for the wind to become uniform over large areas and during large periods of time.

3. For guns which habitually fire at such elevations that relatively low maximum ordinates result, surface conditions, whose effect may reach up to 500 or 1000 yards altitude, are of importance. As the altitude increases the velocity of the wind usually increases. For mortar and antiaircraft firing the upper winds are of relatively greater importance.

4. The Meteorological Section at Aberdeen Proving Ground determined that the wind at two points differing by 25 miles could be assumed the same without appreciable error. The area between the two stations used in this test bordered on the head of Chesapeake Bay and there were few irregularities of terrain which could cause the surface wind to change radically with change of position. The average height of the 45 flights made was about 3300 yards. Individual flights made simultaneously at each station indicated an average difference of 1.8 miles per hour in velocity and 4 degrees in azimuth of the wind.

5. Simultaneous wind measurements were made at Langley Field, Fort Monroe and Fort Eustis. The test covered a period of about two weeks, December 10-20, 1923, flights being made at 8:30 and 11:00 A. M., and 2:30 P. M., daily, except Sunday. The distance from Langley Field to Fort Eustis by air line is 13 miles; the distance from Fort Monroe to Fort Eustis is 19 miles; the distance from Fort Monroe to Langley Field is six miles. The intervening country is flat and borders on the mouth of Chesapeake Bay and on James River.

6. The final results as given in the table show that the average difference to be expected from making a wind measurement at Fort Monroe or Langley Field and from using this value for firings at Fort Eustis, instead of the value obtained from a measurement made at Fort Eustis itself, is about 1.8 miles an hour in velocity and 5.6 degrees in azimuth, for maximum ordinates of about 2000 yards. Winds are measured and tabulated to the nearest whole mile per hour and the nearest 5 degrees in azimuth.

7. Further consideration of the table brings out such cases as those of December 11th at 8:30, December 13th at 8:30, 11:00 and 2:30, December 17th at

11:00, and December 18th at 1100. In all of these cases the difference in wind velocity is appreciable. However, in every case but one of these, the height attained was 1100 yards or less, which is lower than the altitude ordinarily expected in antiaircraft firing.

8. In order to ascertain the extent to which accidental conditions of the moment affected the values obtained at any station, six flights at intervals of 10 minutes were made at Fort Monroe on January 29, 1924, and again on February 7, 1924, with the idea of determining what difference in wind measurement is caused by small changes in time of release of the balloon. The results of those flights show that a difference of 10 minutes in time of release of the balloon would introduce an average difference of 1.7 miles per hour in velocity and 4.4 degrees in azimuth for flights up to 1600 yards. Similar difference might be expected in flights up to 2000 yards, when made simultaneously at Fort Eustis, Fort Monroe and Langley Field. It is believed that fluctuations in wind from moment to moment such as are shown by pressure tube anemometers are sufficient to cause an error as large as the one to be expected from a geographical change of station of about 20 miles.

9. Antiaircraft gunnery methods have not yet been developed to the point where errors of the order herein mentioned are of importance. It is to be remarked that the present system (provisional or otherwise) of making wind corrections in antiaircraft fire are poor because of the use of inaccurate weighting factors and because of the use of empirical formulae based on firings with French guns of type entirely different from the standard American type.

10. The effect of a two-mile-per-hour ballistic wind upon altitude and angle of site at 2000 yards and 4000 yards altitude for antiaircraft guns, is shown in the following table:

3-Inch A. A. Gun, Model 1917, 2600 f.s.

	Altitude 2000 Yards		Altitude 4000 Yards	
Elevation	*Effect on altitude, yards*	*Effect on angle of site, mils*	*Effect on altitude, yards*	*Effect on angle of site, mils*
30°	.6	.3	—	—
50°	.3	.3	1.2	.6
70°	.1	.3	.6	.6

3-Inch A. A. Gun, Model 1918, 2400 f.s.

	Altitude 2000 Yards		Altitude 4000 Yards	
Elevation	*Effect on altitude, yards*	*Effect on angle of site, mils*	*Effect on altitude, yards*	*Effect on angle of site, mils*
30°	.8	.4	—	—
50°	.3	.3	1.6	.7
70°	.1	.3	.6	.6

The effect on altitude is negligible and the effect on angle of site is practically so.

Conclusions: 11. *a.* The error introduced by using the wind measurement at Fort Monroe or Langley Field for firings at Fort Eustis is not appreciably greater than the accidental error to be expected in the measurement at any individual station.

b. In view of the small magnitude of the effect upon antiaircraft fire of the errors found, and on account of the approximate methods used in making ballistic corrections for wind in antiaircraft firing, it is believed that the trouble and expense involved in having each antiaircraft regiment or separate battalion carry its own meteorological equipment is not warranted.

Recommendations: 12. *a.* The Board recommended that antiaircraft regiments and separate battalions obtain meteorological data concerning wind from

the nearest established meteorological station whenever the distance to the station is not greater than 25 miles.

b. The Board further recommended that the Signal Corps be requested to make comparative measurements or studies similar to those made under this project, to determine at what distance and under what conditions meteorological data cannot be assumed to be uniform as applied to antiaircraft and heavy mobile artillery firing.

Project No. 207, Test of Azimuth and Elevation Scales for 3-Inch A. A. Gun, Model of 1917.—

1. *a.* In Project No. 166, "Study and Test of 3-inch Guns on Carriage Model 1917," the Coast Artillery Board made the following recommendation:

> "14. It is recommended that all antiaircraft guns be equipped with azimuth and elevation scales."

b. In reference thereto the office of the Chief of Ordnance stated in 2nd Ind. O. O., dated February 6, 1924:

> "4. Regarding recommendation of the Board in Par. 14, attention is invited to Par. 2 of the subcommittee report. As affecting mounts now in service, it is requested that this office be notified as to whether or not the azimuth and elevation scales shown on Ordnance Office drawings 5-26-57 and 58, and shipped to Fort Monroe are considered satisfactory."

c. Paragraph 2 of the subcommittee report above referred to reads as follows:

> "2. Relative to recommendation 14, above, the azimuth scale will be in the form of a disc mounted on the left side of the carriage and in front of the traversing member. It will be operated from a small rack attached to the base ring. The elevating scale will be on the right side of the carriage and on the fuse range drum in front of the elevating member."

2. The azmuth circle rests on an angle iron. To mount this angle iron it is necessary to chip away the face of the well and the top edge of the emplacement, and lay the angle iron on green concrete, or cement. This cannot be done with the racer in place by filling in with grouting as the drawing seemed to indicate, but the gun must be dismantled and the racer removed. This entails a maximum amount of work that could be avoided if the support were made of cast flat circular segments (as in the mortar azimuth circles) designed to be set in the top of the emplacement but not requiring work on the face of the well.

3. The Engineer Office found it exceedingly difficult to level the azimuth circle. The clearance between the pointer and the scale varies from a bare clearance to a quarter of an inch.

4. The strength of the azimuth circle is open to some question. It is held down only by the grip of the grouting on the small bolts holding the segments of the supporting ring together.

5. Neither azimuth nor elevation scale is direct reading. The pointer is set to an even 10-mil graduation and the mil value below 10 obtained by displacing the pointer by means of the micrometer prior to setting over the main graduation. Such an operation entails slight delays and inevitable errors. Particularly is an error of 10 mils likely to be made since there is no means of telling whether the micrometer, when reading zero, is at the beginning or end of its movement except by studying the movement of the gun entailed should the pointer be moved. To make this point clear, suppose the micrometer read zero, with the pointer over azimuth 270. To determine whether the actual azimuth of the gun is 270 or 280,

set the micrometer to 5 and see whether the gun moves in an increasing or decreasing direction, as the pointer is traversed back to the 270 graduation.

6. The position of the elevation index is very inconvenient to the elevating detail who must lean considerably to the left to see the index. This inconvenience is intensified by the difficulty with which the gun elevates and depresses requiring that the most convenient position relative to the elevating handwheel be assumed by that detail. The azimuth index is convenient to the traversing detail.

7. If the data is changing neither the traversing nor elevating details can operate their micrometers. In no case could the traversing detail operate his, but an additional cannoneer is required who must move around with the gun practically on his hands and knees.

8. The elevation scale interferes with the elevating gear housing at about 1270 mils preventing elevation above that value. Practically the entire scale for the first 300 mils would have to be cut away to insure clearance.

Conclusions: The azimuth and elevation scales are not considered satisfactory. The desirable features contained in the scales on the 1917-MI and 1923-E guns recently tested by the Board warrant the conclusion that the azimuth and elevation scales should be of that type.

Recommendations: The Board recommended that the Ordnance Department be advised that the azimuth and elevation scales covered by this report are not satisfactory, but that the type azimuth and elevation scales provided with the new sighting system for the 1917-MI and 1923-E should be designed for mounts now in service.

COMPARATIVE RESULTS OF SIMULTANEOUS WIND MEASUREMENTS MADE AT LANGLEY FIELD FORT MONROE AND FORT EUSTIS

Date	Time of Day	Langley—Eustis: Height attained yards	Langley—Eustis: Average difference In Speed m.p.h.	Langley—Eustis: Average difference In Azimuth Degs.	Monroe—Eustis: Height attained yards	Monroe—Eustis: Average difference In Speed m.p.h.	Monroe—Eustis: Average difference In Azimuth Degs.
1923							
Dec. 10	8:30 AM	3300	−.6	− 4	Lost	..	..
	11:00 AM	3700	.0	0	3700	−.7	0
	2: 0 PM	1900	.0	− 6	Lost	..	..
Dec. 11	8:30 AM	1100	8.0	− 8	1100	11.4	−14
	11:00 AM	2300	.4	−13	1500	2.7	− 6
	2:30 PM	3300	−.3	− 1	1500	1.4	6
Dec. 12	8:30 AM	1300	−.5	26	1100	−.8	49
	11:00 AM	6100	.2	2	1900	−1.4	−14
	2:30 PM	3700	−1.3	4	890	−3.5	−20
Dec. 13	8:30 AM	680	10.0	3	680	13.6	− 1
	11:00 AM	890	8.0	2	890	2.2	2
	2:30 PM	Low Clouds		..	460	−9.0	− 5
Dec. 17	8:30 AM	1100	3.4	6	2700	.7	− 5
	11:00 AM	680	15.6	1	1500	13.6	8
	2:30 PM	1500	−.4	0	3500	2.6	2
Dec. 18	8:30 AM	680	1.6	− 3	2700	2.1	3
	11:00 AM	680	8.3	−16	680	−9.6	−11
	2:30 PM	1900	2.5	17	3100	2.7	13
Dec. 19	8:30 AM	3900	−.6	− 3	4300	−.[illegible]	− 7
	11:00 AM	890	.7	−17	4500	.8	− 4
	2:30 PM	2300	.4	− 1	2700	−.1	− 1
Dec. 20	8:30 AM	Rain	..	..	1100	1.4	2
	11:00 AM	Rain	..	..	2100	.5	− 1
	2:30 PM	2100	1.2	− 5	1100	1.6	− 3
Dec. 21	11:00 AM	1500	.7	5	1500	2.9	1
	2:30 PM	Low Clouds		..	4100	.7	0
Mean Difference			1.4	5.2		2.3	6.0
Mean Height		2080			2060		

BULLETIN BOARD

Playing the Game

By Major W. K. Wilson, C. A. C.

Editor's Note: *This is the third of a series of "five minute" talks by Major Wilson. The first, "Our Aim in the Military Service," appeared in the February issue of* The Journal. *The second, "Success in the Military Service," appeared in the April issue. It is believed the subject matter of these addresses is particularly suited for use by organization commanders in short talks to their commands.*

It is interesting to note in our daily conversation that we use expressions which convey meanings differing widely from the actual meanings of the words themselves. Such expressions are called "Figures of Speech," and I am taking the figure of speech "Playing the Game," as a basis for my remarks today.

We have often heard a man say: "I admire Smith very much. He is a man who always plays the game," or "I don't think much of Jones. He is a very smart man but never plays the game." What did he mean by "Playing the Game"? Did he mean a game of cards? No. Did he mean a game of football or a baseball game? Certainly not. What then did he mean by "Playing the Game"? He meant the game of life. He was calling life a great game in which each one of us is a player. This figure of speech undoubtedly arose from the American love of good sport. Today the expression, "Playing the Game," is in common use. We hear it on every hand. The question you and I should ask is "Am I playing the Game?"

In considering some of the essentials which are necessary to make our game of life successful, the first essential that comes to mind is that of effort. It is hard to conceive of a good game of any kind in which the players are not putting forth great efforts to win. In some games such as cards, chess or checkers the effort is entirely mental. In other games such as baseball, football or boxing the effort must be both physical and mental.

It is generally conceded that the best game of all is one where the players are evenly matched and where each player is putting forth his maximum effort to win. A boxer who knocks out his opponent without having to exert himself gets very little satisfaction out of the fight. A tennis player or golf player who defeats his opponent without putting forth great effort is ever satisfied with the victory. That which we get without effort is worth very little to us. The valuable things in life come only through hard work. Our military profession is a noble one and worthy of our maximum effort. Let's play the game to win.

The second essential in the game of life is fair play. I am thankful to say that the average American will insist upon fair play. He cheers when a player outwits his opponent, but he has no patience with the man who takes an unfair advantage in a game of any sport. In the days of the Wild West, it was considered proper to shoot any gambler caught cheating at cards. Horse thieves were hanged without mercy. Fair play was demanded. You remember a few years

ago, how the whole nation was stirred up over the selling out of one of the World's Baseball Series. You remember also how quickly the baseball managers expelled the guilty players, and barred them from the game forever. The American public will not support any form of sport which is not played fair, and the player who violates the rules is not only hurting himself but he is hurting his own team. A slogan which I suggested for our football team last year is one which we may well adopt for our game of life: "Fight hard, but fight fair."

The third essential in the game of life is self-control. It so often happens in a game of any kind that the player who loses his temper also loses the game. In fact, you occasionally see a player try to make his opponent angry, in order that he may have the advantage of a cool head and deliberate judgment over his opponent. A football player who spends his nights in drinking or in any other form of dissipation cannot hope to play much of a game the next day. In fact he is lucky if he does not bring defeat and disgrace upon his team. We cannot afford to lose our self-control in the military service. In any emergency, a drunken soldier is worse than no soldier at all, and it has been my observation that any man who gets drunk occasionally, is always drunk when you need him the most. Self-control is especially important for officers and non-commissioned officers, for truly if we cannot control ourselves we have no right to expect to control others.

The fourth essential in the game of life is good team work. In this essential, the game of life differs from such games as checkers and chess where one single player meets his opponent. In the game of life we do not play singly, but as members of a team. Man cannot live alone. He has tried it many times, but has always failed. No man can escape the influence of other men, nor can he fail to influence others. In other words, whether he wishes it or not, he is a member of a team in the game of life.

In a tug-of-war team, each member must not only pull, but he must pull with other members of his team. A man who is not pulling at all is a dead loss to his team, but a man who is pulling against his team is a menace to the success of his team and must be eliminated. In the Army we have a team of the highest order, and the success of our Army depends upon the team work of its members. Unfortunately we have a few members who are pulling against the team. They are spending their time finding fault, with everything. They complain about their food. They complain about their work. They complain about their officers and their non-commissioned officers. They are actually making the work of the team harder, and they must be eliminated if our team is to win. Again, we have a few members who are pulling with the team, but only half-heartedly. They attend their drills and instructions but do not put forth much effort to learn. They have no desire to do any more than to get by with their work. Then, too, we have a few members who are not pulling at all. They go absent from their duties and let others perform them, and they get sick not in the line of duty and others have to do their work. Finally, we have those members of our team who are putting forth every effort for its success. They recognize the sacred trust which has been placed upon them, and each day glory in the performance of duty well done. They are the ones upon whom America can depend. In other words, they are "Playing the Game."

You may now be asking yourself the question: "How can I play my part in this great game?" You will soon be graduates of the Noncommissioned Officers' School and will be going back to your organizations. You will be leaders in the team, and your responsibility will be very great. It will be your duty to keep

those about you interested in their work. A word of encouragement spoken by you at the right time will do wonders. In your squads, there may be young men away from home for the first time. Some of them may be homesick—you can cheer them up. Some of them may be starting out with a crowd you may know to be tough. All they need is a word of advice from you. Take each one by the arm, and talk to him as if he were your own brother.

Finally, you can help most by your example. Be careful to do everything right yourself. If you go around with your coat unbuttoned, you can't expect a new man to button his. If you growl at every order you get from the captain or first sergeant, the new man will soon be growling about your orders. If you accept every order from higher authority cheerfully and carry it out promptly, if you take great pains with your clothing and equipment, if you are precise in your manual of arms, and other drills; if you are careful to perform your guard duty strictly according to orders, you will soon find that your squad will do likewise and that you will have commands of which you may justly be proud.

Our country needs men today. Men, who are willing to fight her battles with gun and bayonet; men who are willing to fight her battles for law and order so that she may stand firm in peace as well as in war; men who are willing to "Play the Game."

The Military Attache

By Major H. W. T. Eglin, C. A. C.

Foreign Liaison Officer, U. S. War Department, in charge of U. S. Military Attachés

[Reprinted by permission from *Congressional Digest* of January, 1924.]

The success of any organization or activity is dependent in no small degree upon information of methods employed by parallel organizations which exist for the same purpose. Consequently, it is sound business policy for a government to learn and exchange ideas with other governments on the subject of national defense. This is accomplished by Military Attachés abroad, who are constantly on the lookout for new ideas which can be applied to their own army. The subject is very large and covers a varied field, but in general might be mentioned organization of various arms and units, principles of training and instruction, comparison of requirements of technical material, equipment of the soldier and equipment of units of an army, the study of rations, clothing and shelter, the performance of aircraft, both heavier and lighter than air, care and training of animals, the service of supply, the cost of maintenance of troops, the organization and training of reserves, the mobilization of man power and industry.

The American Military Attaché system, as at present organized, comprises twenty-two Military Attachés and nine assistants from the line of the Army; five special assistants from the Air Service; and one special assistant from the Ordnance Department. They are stationed in the capitals of twenty-two foreign countries and, by grouping of countries, cover forty-seven in all.

The Military Attachés are attached to our embassies and legations and, in addition to being the military advisers of the Ambassador or Minister, they are specifically charged with the collection of information on the military situation in the countries to which they are accredited. These reports are forwarded to the Second Division of the General Staff of the War Department, where specially trained officers digest them and maintain an accurate study of each country with respect to the military situation. These are called Information Digests and are always kept up to date, as changes in the situations occur.

Every effort is made to insure that copies of reports of Military Attachés are sent to the appropriate branch or bureau of the War Department, or of such other executive department as may be directly concerned.

The second division of the General Staff maintains a section which is the central coordinating agency of the War Department for the administration of our military attaché offices abroad. This section is also the central coordinating agency of the War Department for the transmission of corresponding information concerning our military establishment to the Military Attachés of foreign embassies and legations in Washington.

The C. A. C. With the Japanese Relief Expedition

By Lieutenant Charles Himmler, C. A. C.

Editor's Note: *Perhaps it is mercifully for the best that most of us who read of the disaster of September 1, 1923, when a quarter of a million human beings succumbed to the fury of an earthquake such as the world has never before known, can grasp but blurred and fragmentary impressions of that tragedy of inconceivable horror. At 11:56 A. M., September 1, Tokyo was a teeming metropolis with a population of approximately three million. At 11:57 A. M., the first great shock occurred. The ground dropped vertically for three feet. Steamers in the harbor vibrated so violently that their decks were torn loose. Shock after shock, then fire and typhoon. Sixty-five square miles of devastated area with hundreds of thousands of men, women and children killed and maimed. The brief article which appears below was requested in order to make of permanent record in the pages of* The Journal, *the role played by the Coast Artillery Corps in the relief work that followed this terrible catastrophe.*

On the evening following the great quake, we bachelors of the 59th Artillery, C. A. C., were sitting about the mess table, discussing our hard luck on losing the Southern Island trip. Happening to glance at the Manila Bulletin, I noticed that a great disaster had occurred in Japan, but considered the possibility of any of us going there so remote, that the subject was not even brought into the conversation.

September 5th, Captain E. E. Murphy, 59th Artillery, C. A. C., and I went down to the range as usual to continue pistol practice with our battery. About 10:30 A. M., an orderly from headquarters called Captain Murphy away, leaving me in charge of the battery. At 11:30 A. M. the same orderly came for me and delivered instructions for me to report to headquarters, where I was told to be ready to sail for Manila on the one o'clock boat, prepared for field service in Japan. This left half an hour to pack, so I called a detail to assist me, drew another pistol on the run, and hurried to my quarters to pack. There I found Captain Murphy engaged in the same task, and in a few minutes we were on the baggage truck bound for the dock, where Captain Murphy took charge of the Coast Artillery waiting there. Colonel P. P. Bishop, 59th Artillery, C. A. C., our commanding officer, and Colonel Morse, M. C., were also there without any more information than the rest of us possessed, namely, that we were going to Japan, just what for none of us knew.

Due to the fact that the San Pedro was pulling a tow, it took us until nearly 6:00 P. M. to reach Manila. Upon arrival at the dock we were met by a heavy downpour of rain, but nevertheless proceeded to transfer men and baggage to the U. S. A. T. *Merritt*, which was being loaded with relief supplies, as quickly as possible.

The next day we left Manila, enroute for the land of mystery, for we received no news from Japan other than that a great earthquake had occurred. After being at sea several days, with the ship tossing about like a cork on the typhoon ridden ocean, a questionnaire covering fitness for the various duties required in relief work was filled out by all officers on board. One of the duties listed wa

M. P. work, lack of news preventing us from knowing that the Japanese had the situation well in hand.

The *Merritt* arrived in Yokohama on the evening of the 14th of September. Some buildings appeared to be standing, but a later inspection showed that they were only skeletons, the entire city being destroyed. Shore authorities were immediately gotten in touch with, and unloading began the following morning. Lieutenant Clark, M. A. C., and I were placed in charge of unloading, under Lieutenant Colonel Sunderland, G. S., a former C. A. C. officer. The work of unloading was speeded up as much as possible, since no camp could be pitched until everything was out of the holds, as all the tentage was in the bottom of the forward hold.

It took three days to unload the *Merritt*, due to the shortage of Japanese barges, many of which had been destroyed in the great fire. As soon as the *Merritt* was unloaded, General Read and his staff, and Colonel Bishop returned to Manila.

Shortly after our arrival in Yokohama, Lieutenant Colonel D. W. Hand, F. A., was made commanding officer of troops, under General McCoy, who had his headquarters in the Imperial Hotel at Tokyo. The Japanese gave the colonel a camp site on the filled in section under the bluffs on which the foreign settlement had been, and all officers were soon on duty constructing a semi-permanent hospital camp. Cracks in the ground had to be filled in, gangs of Japanese coolies under American officers cut the grass and weeds covering the camp site with axes, no other tools being available, roads had to be built and repaired, brick from the ruins being used for this purpose.

Captain Murphy was made mess officer and immediately proceeded to see that the best meals possible under the circumstances were gotten out. The mess was so good that people from the Imperial hotel were glad to eat there.

It was at the mess one day that we met Lieutenant T. G. Cranford, formerly of the 59th Artillery, a Japanese language student, who had gone through the earthquake, and was then connected with the American embassy. He gave us a vivid account of his experiences during the quake. Lieutenant Cranford had to make a trip from Tokyo to Yokohama on the night of the disaster. Bicycle was the only means of transportation, but he was forced to dismount continually during the ride to carry his bicycle over the dead bodies in the road. He spent the night on the plain under the bluffs at Yokohama, in company with a host of refugees from the burning city of Yokohama.

At first I assisted in the transfer of supplies from the dock at Yokohama to the camp site, and later in pitching tents and in constructing roads about the camp. All the men, although picked for their merit as soldiers, were unfamiliar with pitching pyramidal and hospital tents, and had to be instructed therein, so the work proceeded rather slowly at first.

After everything but the ward tents were up, a typhoon tore down most of the camp. The tent poles would sink several feet into the subterranean cracks caused by the earthquake and in a short time the occupant would find himself using the tent as a blanket. We took shelter as best we could during the night, and spent the next day rebuilding camp, Captain Murphy taking great pains to erect a storm proof kitchen.

The U. S. A. T. *Meigs* having arrived in Tokyo, Colonel Hand detailed me to command the advance guard of fifteen men. We proceeded to Tokyo on a destroyer, had our lunch at the Imperial hotel and proceeded to erect our camp. We were located at Tsukidje, on the Sumida river, which place was to be the

big dump for relief stores. From this point supplies were turned over to the various relief organizations, such as the American Embassy, Japanese Red Cross, schools and hospitals.

The night the Japanese were mourning their dead, was one of the weirdest spent by the advance guard. Lying in our tents we could hear the doleful chant of the coolies in the distance, each verse ending in guttural cries of Wah! Wah! Shortly after the mourning was well under way, another earthquake began. The chanting ceased for a moment and then began again. It gave us all a creepy feeling; I know for my part it wouldn't have been a surprise to see a ghost come floating into my tent through the open fly, everything seemed so eery and weird.

About October 3rd, Lieutenant Walsh, Infantry, arrived with a detachment of men, and a few days later the main body arrived and proceeded to Bei-Hi, the site of the big hospital camp on the palace grounds of Prince Matsukato in Asabu-Ku. Captain Murphy had charge of the mess at the large camp also. At Bei-Hi, a large camp hospital consisting of numerous ward tents, tropical hospital tents, pyramidal and wall tents for quarters, was put into shape in a few days. Captain Murphy here had charge of the erection of a large field bakery, which enabled the camp to make its own bread. An elaborate field mess was established, boys from the ruined Grand hotel at Yokohama acted as mess boys. The mess was strung with Japanese lanterns and carpeted with burlap in order to provide a fitting place for the reception of high ranking guests. There were nearly two hundred tents erected in this camp, but as the officers of the C. A. C. had nothing to do with the erection of anything but the kitchen and baking facilities, the details of pitching camp will not be gone into.

While Captain Murphy was stationed at Bei-Hi, I remained at St. Luke's, assisting Major Callender and other officers in the distribution of supplies to the various relief agencies in order to clear the dump for use as a camp site, and in unloading the barges from the *Meigs* and *Somme*. The *Somme* was anchored at Yokohama, consequently most of the supplies aboard her were sent to Tokyo by rail. It was my duty to erect a hospital camp at Tsukidje to replace the old St. Luke's hospital which was destroyed in the quake. Specifications for the camp were laid down by Major Callender, M. C., and Dr. Tauschler, formerly in charge of St. Luke's. Since it was obviously impossible to use the dump at Tsukidje for a camp site, due to the congestion there, a better site two blocks south of the dump was selected. This location was enclosed by the ruins of what had formerly been a hospital, but a large tract of flat land was left available for use as a camp site. With fifteen men of all branches and a gang of green coolies, the hospital was laid out and pitched the same day. The fastest time we made in laying out and pitching a large hospital ward tent, 50x16 feet, was twenty-five minutes, actual pitching taking about fifteen minutes, which was good time, considering the inexperience of the men. That evening a typhoon blew down half of what had been erected during the day, but the damage was soon repaired the following morning. Instruction in tent pitching was then given the Japanese interpreter, so that he could take charge of repitching camp in case of another typhoon after our departure.

October 13th I moved my detachment up to Bei-Hi to join the main body in the ceremonial turn-over to the Japanese Red Cross. It was a very impressive sight to see the American flag lowered and the Japanese flag rise to take its place. There were speeches by the Japanese, the American ambassador, and General McCoy, followed by a tour of inspection of the camp, officers escorting the distinguished guests around the hospital and our work was done.

All through our stay in Japan, the duties of the C. A. C. in the relief mission were so closely bound up with the tasks performed by officers of other branches that it is hard to pick out any one job and say "The C. A. C. did that." Rather, we of the C. A. C. did our best to cooperate with all the other branches represented in the mission, and, I believe, succeeded.

The remaining four days of our tour in Japan were spent in traveling through the country under the auspices of the Japanese government, Captain Morishima of the Japanese army acting as official guide. The relief mission visited the cities of Kobe, Nara, Kyoto, Osaka and Nagasaki, taking the inland sea route from Kobe to Nagasaki. The mission was royally entertained at all these places, especially in Osaka, where cheering crowds lined the streets as the relief party rode by. Receptions for men and officers, with food both in Japanese and European style, singing and dancing by Geisha and Yamatoya girls, speeches of welcome and thanks by Japanese officials were the rule at all places.

The *Somme* then carried the mission to Manila, where we arrived October 26, 1923, after almost two months of life in Japan, under conditions never to be forgotten.

A Single Promotion List for the C. A. C. Noncommissioned Staff

The establishment of a single promotion list has been approved by the War Department, to become effective upon the publication of A. R. 615-5. It is based upon three considerations, as follows: *a.* As a general rule noncommissioned staff officers should secure promotion in accordance with their length of noncommissioned staff service. *b.* The present *lineal* standing of noncommissioned staff officers in each class should not be disturbed. That is, an electrician who precedes another electrician on the present lineal list for that class should also precede him on a single promotion list. *c.* The technical grade should be established for Sergeants Major and Master Gunners.

The promotion of noncommissioned staff officers in accordance with separate lineal lists, and the withholding of the technical grade from Sergeants Major and Master Gunners, have resulted in an unequal flow of promotion among the several classes. Some noncommissioned staff officers have secured promotion to the higher grades with undue rapidity; others have been correspondingly denied promotion to which they are justly entitled by length of noncommissioned staff service. The several classes of noncommissioned staff officers are considered of equal importance; they are sent to the same school preparatory to their appointment; they all become members of the same body—the Coast Artillery noncommissioned staff. They should, if possible, secure promotion at approximately the same rate. An electrician and a master gunner graduating from the same class and with the same standing at the Coast Artillery School should, at the end of a period of years, hold the same grade and draw the same emoluments. They should certainly be permitted to retire at the same grade and rate of pay. They are denied this right, however, under the present system. If a surplus of noncommissioned staff officers happens to exist through some cause in the higher grades of a particular class, the staff sergeants in that class are denied, because of the separate lineal lists, the promotion to which they are entitled. The fact that sergeants major and master gunners cannot hold the technical grade, serves to further retard the promotion of men of those classes.

The present system is not only unfair to the noncommissioned staff officers concerned, but is not for the best interests of the service. The knowledge that there is a more rapid rate of promotion in other classes has caused noncommis-

sioned staff officers to become dissatisfied with the opportunities presented in their own class. The present inequality creates a desire on the part of candidates for appointment in the noncommissioned staff, to seek, without regard to their natural inclinations and abilities, enrollment in those courses at the Coast Artillery School which appear to afford the most rapid promotion.

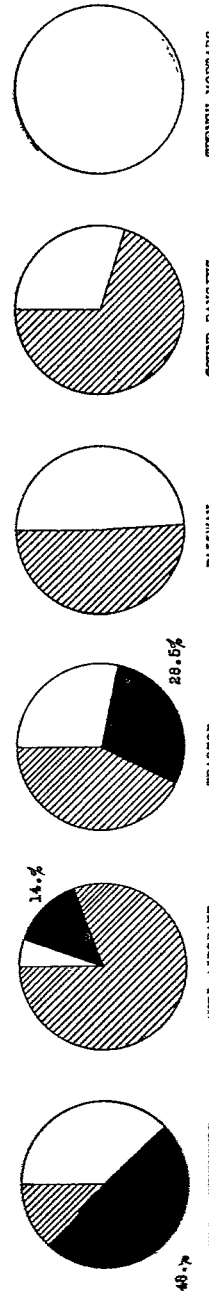
Under the single promotion list noncommissioned staff officers will be promoted to master sergeants and technical sergeants in order of their standing on the list, without regard to class, i.e., whether electricians, master gunners, sergeants major, or radio sergeants. Master sergeants have been omitted from the promotion list, as no purpose would be served in listing them. They have, however, been placed on a separate list in order of dates of warrant for the purpose of showing rank among themselves. All technical and staff sergeants have been placed on the promotion list as far as practicable in the order in which they entered the noncommissioned staff. Where a group of enlisted men entered the staff at the same time as in the case of a graduating class, they have been placed on the list in accordance with their class standing, in those cases where such standing is of record, otherwise in accordance with length of service.

As by the single list, noncommissioned staff officers will be promoted in accordance with their standing on the list without regard to class, the number of noncommissioned officers in any particular class must be maintained by appointing to the grade of staff sergeant an enlisted man on the eligible list pertaining to the class in which each vacancy occurs. For example, a master sergeant (electrical) retires; promotions to the grade of master sergeant and technical sergeant follow in accordance with the single list without regard to class. The vacancy created in the grade of staff sergeant should be filled by the appointment of a staff sergeant (electrical). Due to the fact, however, that there is a present shortage of five (5) electricians and three (3) radio sergeants in the noncommissioned staff and a corresponding surplus of sergeants major and master gunners, all appointments will be made in the electrical and radio classes until the vacancies in these classes are filled.

In the operation of the single list, two conditions must be fulfilled. First, the number of noncommissioned staff officers in each grade must not exceed the War Department allotment, that is, the number of master sergeants must not exceed 81, the number of technical sergeants 82, and the number of staff sergeants 210 (supply sergeants, color sergeants, and assistant band leaders are not included in these figures). In the second place, the total number of electricians, sergeants major, etc., must not exceed the number at present authorized. There are at present authorized in all grades, 225 electricians, 77 sergeants major, 40 radio sergeants, and 31 master gunners. This distribution must not be disturbed, as it is based on the needs of the service.

It is believed that the single promotion list will be generally accepted as a just and logical remedy for the present inequality in promotion. It is correct in principle, and eventually should work substantial justice to all. A few individuals will necessarily suffer, but only to permit those who have been unjustly deprived of promotion, to move up into their proper places. Under operation of the list, adjustments will be made gradually and with minimum disruption of present conditions. A considerable increase in the noncommissioned staff has been asked for. The increase includes 12 master sergeants, 34 technical sergeants and 50 staff sergeants (63 electricians, 15 sergeants major, 8 master gunners, and 10 radio sergeants). If this increase be granted, the single list will work out even more smoothly and with less disturbance than at present contemplated.

TYPE	REGULAR ARMY	NATIONAL GUARD	ORGANIZED RESERVES
FIXED DEFENSES	36. %	48. %	14. %
ANTI-AIRCRAFT	5.5	14	80.5
TRACTOR	28.5	28.5	43.
RAILWAY	49.	----	51.
SOUND RANGING	30.	----	70.
TRENCH MORTARS	100.	----	----



PLANNING SECTION
MILITIA BUREAU
WAR DEPARTMENT
MAY 1, 1924.

LEGEND:

REGULAR ARMY
NATIONAL GUARD
ORGANIZED RESERVES

PERCENTAGE REQUIREMENTS OF THE COAST ARTILLERY FOR THE THREE COMPONENTS OF THE ARMY, UNDER THE W. D. MOBILIZATION PLANS

Report on Fund Raised for Rifle and Pistol Teams

To enable the Coast Artillery Rifle and Pistol Teams to function with the highest degree of efficiency, the Chief of Coast Artillery suggested that a fund be raised from among the commissioned personnel of the Corps. Acting on this suggestion, THE JOURNAL undertook a campaign by correspondence with the commanding officer of each District and Coast Defense, with the following result. To date, $562.92 has been collected and turned over to Major C. W. Baird, C. A. C., Team Captain.

C. D. of Balboa	$29.00
C. D. of Baltimore	1.00
C. D. of Boston	9.00
C. D. of Charleston	1.00
C. D. of Chesapeake Bay	40.50
C. D. of Columbia	2.00
C. D. of Cristobal	38.00
C. D. of Delaware	1.00
C. D. of Galveston	1.00
C. D. of Honolulu	24.00
C. D. of Key West	1.00
C. D. of Long Island Sound	10.00
C. D. of Los Angeles	9.00
C. D. of Narragansett Bay	10.00
C. D. of Eastern New York	21.00
C. D. of Pearl Harbor	26.00
C. D. of Pensacola	8.00
C. D. of Portland	6.00
C. D. Manila and Subic Bays	66.42
C. D. of Portsmouth	$ 1.00
C. D. of Puget Sound	15.00
C. D. of Sandy Hook	11.00
C. D. of San Francisco	25.00
C. D. of Savannah	1.00
1st C. A. District	24.00
2nd C. A. District	3.00
4th C. A. District	7.00
9th C. A. District	5.00
Hawaiian C. A. District	6.00
Panama Canal C. A. District	3.00
Office, Chief of C. A.	10.00
Fort Eustis	28.00
Coast Artillery School	91.00
P. H. Worcester (Leav'worth)	1.00
E. D. Y. Ostrom	1.00
L. B. Magruder	1.00
R. C. Eddy	1.00
64th C. A. (Fort Shafter)	25.00

The United States Flag

The United States flag was born June 14, 1777, in Philadelphia, Pa. Myth, tradition and legend assigned the designing and making of the first United States Flag to Betsy Ross, a Quakeress, of Philadelphia. The same myth, legend and tradition states that she made this flag at the suggestion of a committee of Congress, composed of George Washington, Robert Morris and George Ross. This myth, legend and tradition is not authenticated by any written or printed documents of the day, and only had its birth as a public fact about 1870, when the country was getting ready to celebrate the centennial of the Declaration of Independence at Philadelphia.

The authentic history of the flag begins on the hour and day when the Continental Congress:

"Resolved, That the flag of the thirteen states be thirteen stripes, alternate red and white; that the Union be thirteen stars, white in a blue field, representing a new constellation."

Who presented the resolution or how it was brought to a vote in Congress is not known. So the flag stands without father or mother, as far as recorded history is concerned, and the beautiful Betsy Ross theory cannot be substantiated.

The United States flag was borne of revolution and baptized in blood and tears, but from the hour it was brought into existence by the Continental Congress to the present day it has been the symbol of Light and Liberty, of Justice and Equality, of Patriotism and Progress.

It has floated for nearly a century and a half, the pride and glory of three millions of people in 1777, and one hundred and twenty millions in 1923.—*The United States Flag, by* I. W. BALL.

PROFESSIONAL NOTES

New Types of Antiaircraft Artillery

EDITOR'S NOTE: THE JOURNAL *is indebted to Captain D. D. Hinman, C. A. C., for the following notes. Captain Hinman has been closely affiliated with antiaircraft experimental work in the Coast Artillery for the past several years, and has witnessed the test firings of these guns at Aberdeen Proving Ground.*

It is believed the following photographs and characteristics of antiaircraft gun materiel under development at the present time by the Ordnance Department for the Coast Artillery will be of general interest to the service. Three of the four guns to be discussed in the article are to be sent to Fort Monroe some time

FIG. 1

this summer for firing and road test by the Coast Artillery Board and the 61st Coast Artillery (Antiaircraft). These consist of the 3-inch A. A. Mount, Model 1917 M-1; 3-inch A. A. Mount, Model 1923 E; and 3-inch A. A. Gun, Model 1920-E. The 4.7 A. A. Gun, Model 1920-E is not as yet ready for test by the Artillery Board and will not be included in the guns tested at Fort Monroe this summer.

The 4.7 A. A. Gun called for by the Westervelt Board is still in the experimental stage. The gun shown in Figure 1 is mounted on a Christie self-propelled carriage. Whether or not this type of carriage will be suitable for this type of gun is yet to be determined, and the gun and carriage will require considerable

more experimental work before being suitable for issue to the service. Near the muzzle end of the 4.7-inch gun will be noted another device new to most artillerymen, the muzzle brake, this is still however in the experimental state. Its characteristics are as follows:

Length of bore in calibers, 42; muzzle velocity, 2600 f.s.; weight of projectile, 45 lbs.; travel of projectile, 176.534 ins.; weight of powder, 11.7 lbs.; weight of gun, 5183 lbs.; remarks, sliding block; semi-automatic; S. P. Wheel; Caterpillar; Christie.

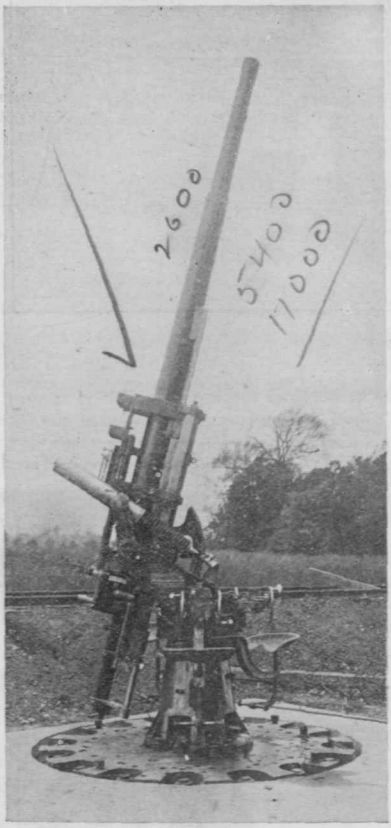


Fig. 2

Fig. 3

The 3-inch A. A. Mount, Model 1917 M-1 is a fixed mount and was built from specifications furnished the Coast Artillery Board in order to overcome defects that had been found in the 3-inch A. A. Mount, Model 1917. The characteristics of this materiel are given in the following table:

Gun: Length of bore in calibers, 55; muzzle velocity, 2600 f.s.; weight of projectile, 15 lbs.; muzzle energy, 703.8 ft. tons; weight of charge, 5 lbs.; twist of rifling, increasing 1 in 25 to 1 in 50; number of grooves, 24; maximum service powder pressure for 2600 f.s., 36,000 lbs. to square inch; weight of gun, complete, 3100 lbs.

Mount: Maximum elevation, 85 degrees; minimum elevation, —5 degrees; traverse, 360 degrees; length of recoil (constant), 12 inches; type of recoil

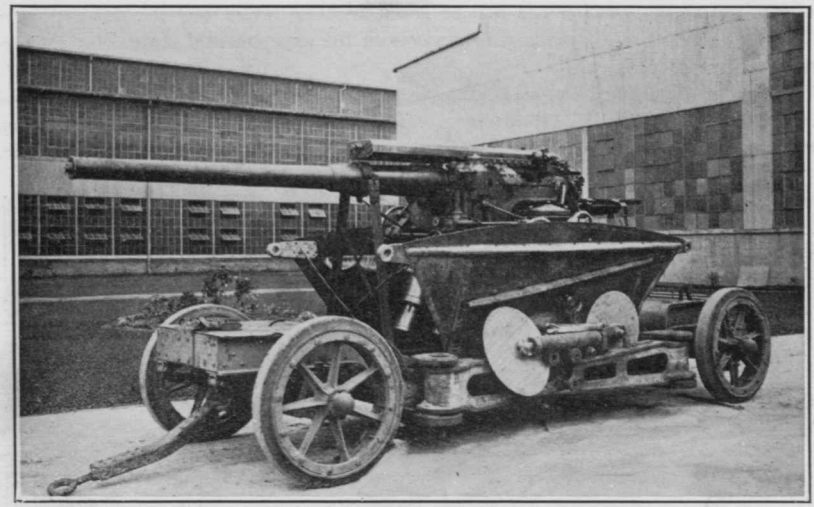


FIG. 4

mechanism, hydro-spring; type of breechblock, vertical sliding; weight of mount, with gun, 13,600 lbs.

This gun was tested at Aberdeen and adopted for our future 3-inch Fixed A. A. Gun. While the tabulation of data shows the muzzle velocity of this gun to be 2600 f.s. the gun and carriage are so constructed that without any change of the materiel whatsoever a muzzle velocity of 3000 f.s. can be obtained. This is

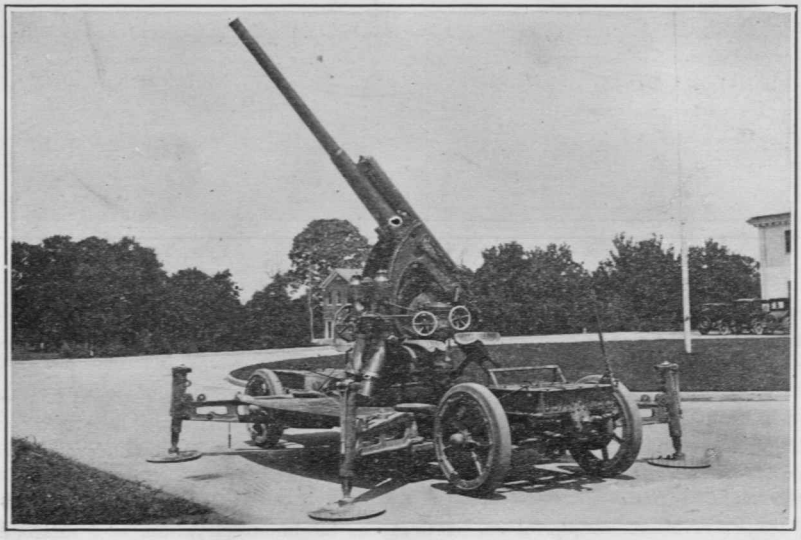


FIG. 5

believed to be a distinct advantage for most Antiaircraft Artillerymen are firm believers in high muzzle velocity.

Figure 2 shows the new 3-inch *Mobile* Gun, Model 1923 E. The figure shows the gun mounted on a fixed mount for test purposes only. The characteristics of the materiel are given in the following table:

GUN: Length of bore in calibers, 50; muzzle velocity, 2600 f.s.; weight of projectile, 15 lbs.; weight of charge, 5 lbs.; twist of rifling, uniform 1 in 40; volume of powder chamber, 200 cubic inches; volume of bore, 1109 cubic inches; maximum service pressure (powder) 34,000 lbs. to square inch; weight of gun, complete (approximate), 1950 lbs.

MOUNT: Maximum elevation, 80 degrees; minimum elevation, —5 degrees; traverse, 360 degrees; leveling, in all directions, 5 degrees; length of recoil (constant), 32 inches; type of recoil mechanism, hydro-pneumatic; equilibrators, pneumatic; weight of mount with gun (approximate), 5750 lbs.

TRAILER: Size of wheels (4, rubber tired), 37x6 inches; tread, 61 inches; wheel base, 156 inches; steer, front and rear; special outriggers; weight of trailer (approximate), 6000 lbs.; total weight of gun, mount and trailer (approximate), 11,750 lbs.

The trailer and outrigger system is similar to that shown in Figure 4, for the 3-inch A. A. Gun, Model 1920 E. The 3-inch A. A. Gun, Model 1923 E was developed as a result of the experimental work shown in firing and testing the 1920 E trailer mount.

The 3-inch A. A. Gun, Model 1920 E will also be tested at Fort Monroe. (See Figures 4 and 5. It is the first experimental mobile antiaircraft gun developed after the war, and has many improvements over our previous materiel. It is to be noted that on both the 1920 E and 1923 E and the 4.7 1920 E mounts, the type of recoil mechanism used is hydro-pneumatic. This type of recoil mechanism will insure greater rapidity and smoothness of fire. Moreover, two of the three new mounts are provided with equilibrators, thus allowing the gun to be mounted at a point close to the breech in place of the old practice of mounting the gun at the center of gravity. By using equilibrators the amount of recoil is not changed, but it permits the trunnion of the gun to be mounted much lower and thus insure stability during the firing. The characteristics of the 3-inch A. A. Model 1920 E are as follows:

Length of bore in calibers, 50; muzzle velocity, 2600 f.s.; weight of projectile, 15 lbs.; weight of powder, 5 lbs.; weight of gun, 2158 lbs.; remarks, sliding block (semi-automatic).

A separate sighting system is to be mounted on each one of the three guns sent to Fort Monroe for test in order that the Artillery Board and the 61st Coast Artillery may determine which of the three systems is most satisfactory for antiaircraft fire.

Mechanical Armies

We have seen that communications, the real basis of civilization, have revolutionized war, directly and indirectly. They have brought about the substitution of nations at war, with complete organization of human and industrial power, for the old system of war between professional armies. Unquestionably they will go on intensifying this trend if wars go on. Aside from the factor of communications, we have seen how much "means of civilization" as chemical industries have brought chemical warfare. And we have had demonstration enough, unless we absolutely prefer to be blind, that the thought of prohibiting the use of such new

deadly agencies as arise as agencies of war is utterly futile. The world is revolted when gas comes in, just as it was revolted by gunpowder, and shortly the resistance melts away, and the new agency is accepted as a natural part of war.

Unquestionably there is to be a further mechanizing of war. The tank, the submarine, the airplane are merely items in that. About the only world benefit that can be seen from this is that it ought to tend to deduct from the prancing steeds, the waving pennons, the ridiculous tinsel and false romance that still in the popular mind are associated with war. One other thing to be kept in mind is that we need expect no lessening of the blood flow and economic destruction, but quite the contrary, no matter how far we mechanize. Increased forces, increased destructiveness are absolutely inescapable. It is only destruction that can bring a warring nation to terms, and the side which destroys on the most terriffic and ghastly scale is the side that will win—if, when it is over, there is anything but mutual disaster.—*Des Moines Register.*

3-Inch Antiaircraft Gun Mount, Model 1923 E

EDITOR'S NOTE: *Army Ordnance for July-August 1924 has the following to say of the Model 1923 E Antiaircraft Gun, a photograph of which is shown on page 270 fo this issue of* THE JOURNAL.

The Gun Mount is designed as a mobile antiaircraft gun trailer mount. The trailer is a modified 3-inch field gun trailer strengthened to carry the heavier load and provided with outriggers for firing. The outriggers and deck are so arranged that they may be readily folded up for transportation.

The gun has a muzzle velocity of 2600 f.s. and is provided with a semi-automatic side sliding breech mechanism. A closing spring is provided which operates to close the block when the extractors are tripped. On counter-recoil the block is opened by a cam so that when the gun is returned to battery the block is open and the empty case has been ejected.

The loading tray is mounted on the left side of the cradle in line with the fuze setter, and is so pivoted that it can be swung into line with the bore for loading. Ramming is accomplished by a hand-operated cable device. The cable is run through pulleys so that the pull may be exerted in any convenient direction. The block on closing pushes the tray clear of the gun. A safety device is provided so that the firing handle cannot be operated until the tray is entirely clear of the gun.

Double handwheels are provided for both the elevating and traversing mechanism for easy operation. In addition, two speeds are provided for both sets of mechanisms and the traversing mechanism has a clutch which may be thrown out to traverse the mount by hand. Since the trunnions are near the breech, equilibrators are necessary, and equilibrators of the pneumatic type have been provided to balance the tipping parts. The handwheel loads for this type of mount are very light and both the elevating and traversing mechanism operate very easily.

The mount has a leveling device of the hemispherical type operated by a nut and cross screws working on the pintle of the top carriage, which permits of leveling the carriage 5 degrees in either direction.

The mount is designed primarily for indirect fire using the deflection and elevation given from a central fire control station. An emergency sighting system is provided on the mount, however. On the left side of the mount a telescope is provided for direction. The motion of the telescope in laying on the target in direction is transmitted to a disc in front of the cannoneer operating the travers-

ing handwheel. Having set the initial correction on his scales he then completes the laying of the piece by keeping the two indices together.

A drum connected to the right trunnion of the piece is so arranged that the cannoneer operating the elevation handwheel lays the gun in elevation by keeping the pointer on the elevation curve being used. The changes in setting in altitude are made by a second cannoneer. The gun and mount weigh 4300 pounds, and the total weight, including the trailer, is 11,600 pounds. The pilot material has been completed and is now at Aberdeen Proving Ground undergoing test.

Materiel and Morale

Colonel George Ruhlen, U. S. A., retired, has rendered a distinct service to the Coast Artillery by translating Colonel Fr. von Taysen's study on the above subject and submitting it to THE COAST ARTILLERY JOURNAL. Furthermore, appreciating that it probably would be too long for publication in THE JOURNAL, he has prepared a summary which gives a clear idea of the subject matter of this paper. This summary is given below, The translation has been bound and accessioned in the Library of the Coast Artillery School, from which it can be secured by anyone desiring to read the same. Colonel Ruhlen's summary follows:

The typewritten pages to which this sheet is attached contain a translation from the German of an article published in pamphlet form in Germany in the autumn of 1923, written by Colonel von Taysen of the German army.

It appears, from what he writes, that when looking back over the frightful losses of men sustained by the French in the World War, especially by the infantry arm at the beginning, the military branch of the French government, when it took up the subject of reorganization and training regulation of its army soon after the close of the war, gave very serious consideration to the study of measures for avoiding such heavy losses in future.

Prominent among measures for that purpose given consideration were increases of the heavy fighting arms—artillery, tanks, machine guns and flyers. It appears there was much public clamor for measures of this kind not only after but even during the war, and the means proposed by the government to bring this about and which were embodied in part in new legislative enactments and in part in regulations adopted or proposed for adoption met with general public approval. The increases of the heavier arms above alluded to necessitated, or at least gave plausible occasion for, corresponding decreases in other directions which, it appears, fell wholly upon the infantry and cavalry. The argument being, apparently, that since the individual losses of the infantry particularly were the heaviest those losses would be materially lessened if the number of individuals exposed were diminished. In regard to the cavalry it seems that the matter of its usefulness in wars of the future came into question and some voices were raised advocating its abolition altogether. As to the infantry the measures proposed and in part adopted were not only a reduction of the number of regiments and of individuals bearing rifles but also provision for giving the infantry more assistance from the other arms and placing it more and more under the protection of artillery, tanks and flyers and providing it with more machine guns and other special infantry arms.

From what the author writes it appears that the infantry at first greatly approved "in principle" at least the proposed measures for giving it better assistance and greater protection by other arms, but violently opposed reduction of its numbers and putting it in a position of a subsidiary and subordinary to other arms, especially to the artillery. Controversies that arose and found

expression in the military professional press in France and to some extent in the foreign press also, apparently induced the government to modify some of its enacted and proposed measures on the subject of reduction and subordination of the infantry and other subjects that were taken up. The opposition crystallized itself into the expression (which the author has used as the title heading of his essay): *"Shall Materiel Overcome Morale?"* that is, shall the fighting instincts of the individual soldier be submerged under a load of war machinery and war implements that are expected to take the place and take upon themselves the functions of the individual fighting infantryman.

The various phases of the controversy that arose between the French military government and the military professional press writers and disputes and contentions between those writers themselves, are taken up and discussed by Colonel von Taysen. His own opinion is that in the new French military system materiel has been given too great preponderance over morale and that the tendency of that course, if persisted in, will be detrimental to real efficiency and will result in making serious inroads upon the fighting morale of the French infantry soldier and furthermore will fail in its primary expectation of avoidance of losses.

The author's sources of information upon which deductions and conclusions are based are study of the French military legislative enactments and army drill and training regulations in part adopted and in part proposed, and information obtained from readings of the French professional military press to which he makes numerous references.

It will be noted that in the last pages of his writing the author refers to a reaction that has set in against the government's apparent measures to reduce the numbers and detract from the power and importance of the infantry arm, but he also expresses his opinion that this reaction is not sincere because it apparently contents itself with opposition to a reduction of the number of infantry regiments and of infantry fighters but wholly misses what he considers the vital point at issue, namely, the French government's conception of the fundamental principles that should govern in its treatment of the infantry soldier when, in his training, it impresses him with the idea that he cannot and should not act on his own fighting impulse in the attack, but await the assistance and protection of the other arms, in other words that the opposition is wasting its efforts in opposing the reduction of the numbers of infantrymen without giving any attention to the diseased fundamental germ cell that will be the sequence of its faulty training methods.

Colonel von Taysen is an enthusiastic champion of the infantry arm among his own military associates. He was a member of the Board of Officers or Military Commission charged with the preparation of the new Infantry Drill Regulations and Infantry Fighting Regulations, for the German Reichswehr. Inasmuch as he would not expect that what he has written would reach the French government and people or would make the slightest impression upon them if it did reach them, it may be assumed that his purpose was to warn his own people against adopting or favoring a system of infantry training that he considers destructive of individual morale and is so radically at variance with the infantry training methods of the English, German, Italian and American methods to which he makes allusion.

Judgment on the question as to the extent to which the author's criticisms of and deductions and conclusions from the French methods are justified must be left to those who may have time and inclination to read what he has to say.

The Keystone of Our National Defense

By Captain W. H. Wells

[Reprinted with permission from *The Outlook.*]

Despite many pacifist or "no more war" societies, war is still an unpleasant reality in many parts of the world. Competition among nations is again becoming intense, and most of them are in debt to us. Who can foretell how long we can keep clear of entanglements? Yet we casually proceed to reduce our Army and curtail appropriations for National defense.

The Panama Canal, representing an investment of $375,000,000 is garrisoned by a smaller number of men than belong to the New York City Police Department; and this in spite of the fact that the Canal is a good business proposition in peace time and of inestimable value in time of war because it means the rapid consolidaton of our Atlantic and Pacific fleets and because in the dry docks and shops at Balboa we have the nucleus of a naval base. Eight thousand men to protect a vital factor in our National defense scheme!

It is obvious that the Canal is susceptible to destruction or capture by three methods: (1) By aerial bombs dropped on a lock or dam; (2) by naval bombardment on the forts at either end; (3) by landing a suitable force and attempting its capture. Our General Staff, after an exhaustive study of these possibilities, made recommendations, of which the War Department approved, but which cannot be wholly carried out. Instead of increasing the garrison, for instance, the reduction of the Army to 125,000 men meant that a squadron of the Twelfth Cavalry had to return to the United States.

Concerning the first two methods of attack—by aerial or naval bombardment —certain of the General Staff's recommendations have not been entirely relegated to the pigeonhole. France Field, the Army air base, is being enlarged and improved; additional Air Service units are expected. But the number of anti-aircraft guns, so essential in combating hostile bombers, is wholly inadequate because of limited funds. The Coast Artillery is also being strengthened with additional 16-inch guns—at present there is one obsolete 16-inch gun at Fort Amador, on the Pacific side. Thus provisions to some extent have been made against the destruction of the Canal.

What of the third possibility—capture of the Canal?—and obviously considering its value intact, an enemy would prefer its capture to destruction. The answer to that question is that the mobile army, which in the last analysis wins or loses the battle, has been neglected.

It must be remembered that the opening attacks of the recent wars were surprises. Russia's first notice of the war with Japan was the attack on Port Arthur. Belgium likewise was surprised by the German invasion. In Panama the coast defenses at Balboa and Cristobal would force an enemy to land in the territory of the Republic of Panama, thus violating her sovereignty. Realizing this, the Republic, strongly allied to the United States, has authorized our troops to operate practically at will in their country, an opportunity immediately seized by our military leaders, since the Canal is particularly vulnerable to an overland attack. By maneuvers held in the Republic our troops have become familiar with every feature of the terrain which has any military importance, have accustomed themselves to the jungle trails, and learned that most important feature of a soldier's work, how to live and keep healthy in the jungle. Ten grains of quinine are

taken every evening; the shelter tents have mosquito bars; all water is chlorinated; in fact, the only thing these maneuvers lack is an enemy.

If there were an enemy, he would, after landing in the Republic of Panama, march overland, directing his attack at Pedro Miguel, Miraflores, or Balboa if the landing were on the Pacific side; Gatun or Cristobal, if on the Atlantic coast. In this manner he would march around our forts and, if successful, capture them at his pleasure. To meet this probable maneuver the Panama Canal Division would take the field. This force of 4500 would have fifty miles of shore line to defend besides the locks, dams, power plants, warehouses, and various appurtenances necessary to the successful operation of the Canal. The War Department realizes that this number is utterly inadequate to fulfill its mission, yet it cannot increase the garrison, because 125,000 men cannot be scattered from the Philippines to New York and leave a sufficient force anywhere.

In the event of a surprise attack, is there any reason to believe the next war should start differently?—the present garrison of the Canal would be unsupported for two weeks. And then a regiment or two might arrive from the States, not acclimated nor accustomed to jungle warfare.

The Panamanians, who are extremely patriotic, would undoubtedly join us immediately in defending their country. But the treaty between Panama and the United States prohibits their maintaining a military force. The only uniformed, disciplined force is the Polica Nacional. Although primarily policemen, its members acted as soldiers in the recent boundary dispute with Costa Rica. The natives, although all expert with the machetes and many of them with shotguns, would be of small use against modern disciplined troops; so that, in the final analysis, the support Panama would give us would be limited to guides, scouts, and assistance in the preparation of field fortifications.

The combat troops comprising our present mobile army in the Zone are the Fourteenth, Thirty-third, and Forty-second Regiments of Infantry, the Eleventh Engineers, and a battalion of the Fourth Field Artillery. During last year's maneuvers two regiments held the shore line, covering every possible landing-place twenty-five miles east and west of the Canal; while the third regiment provided guards for the dams, locks, powerhouses, dry docks, bridges, etc., and formed the reserve. Suppose an enemy made a feint attack on one regiment in order to draw our weak reserves to its support, as it probably would do, and then effect the main landing against the other regiment! The reader can easily imagine the problem confronting the division commander in time of war. With the present garrison the defense of the Panama Canal, undoubtedly rightly considered one of our most prized possessions, would tax the genius of a Napoleon.

Mine-laying Submarines

The Secretary of the Navy has signed the plans for the new mine-laying submarine. Authority for the construction was embodied in the naval appropriation act of May 28, last. The plans contemplate a fleet submarine of the highest practicable speed and greatest desirable radius of action and to cost not to exceed $5,300,000 for construction and machinery and $850,000 for armor, armament, and ammunition. The vessel is one of the nine fleet submarines which formed a part of the celebrated 1916 building program, of which three were authorized several years ago, this being the fourth of this group. The first of the fleet submarine will be launched during the coming week and should be ready for service trials in the autumn. The other two will follow at about five or six months interval.—*Army and Navy Journal.*

Rapidity of Fire of the 155-mm. Gun

The following paragraph appeared in the March, 1924, JOURNAL under an article entitled "Artillery Fire":

> Unfortunately, the gun's life is only about 3000 rounds and it cannot be fired rapidly without decreasing this life. The maximum rate of fire permitted is one round in one and one-half minutes. Besides, it is expensive and the facilities for replacement and retubing are not sufficient. The normal rate of fire is one round in three minutes.

With reference to this paragraph, the Office of the Chief of Ordnance has notified the Chief of Coast Artillery that in its opinion no rate of fire now attainable with the 155-mm. gun will have any material effect in decreasing the accuracy life of the gun. Further, that although the rapidity of fire may have considerable effect in reducing the accuracy life of the guns provided with automatic loading such as machine guns and automatic rifles, there is believed to be no manually loaded gun that can be fired rapidly enough to have any serious effect on its accuracy life.

Plenty of Helium

Enough helium gas is now available in the United States to keep filled and ready for service 200 airships of the size of the navy dirigible *Shenandoah,* so Dr. Richard B. Moore, former chief chemist of the U. S. Bureau of Mines, told members of the American Institute of Chemical Engineers at their meeting in Washington. These ships could be kept in the air for five years, he added. We read further in *Science Service's Daily Science News Bulletin* (Washington):

Dr. Moore predicts the building within a few years of airships of twice the size of the *Shenandoah,* "big enough to carry fuel sufficient for a trip to Europe and return and with enough reserve buoyancy for a good load of bombs if necessary."

Laws for the conservation of the helium resources of the country will be introduced at this session of Congress, Dr. C. S. Lind, successor to Dr. Moore as chief chemist of the Bureau of Mines, told the delegates. The gas occurs principally as a constituent in the natural gas-wells of Texas, and the problem is to separate it from the inflammable part of the natural gas which may then be used for industrial purposes.

Helium-inflated airships are useless for very long flights unless some method for condensing the water-vapor, which is one of the products of combustion of gasoline, is employed. Such a method has been devised. It prevents the ship from getting lighter and lighter, and so having to release helium if it is desired to come to the surface. Rather than lose the valuable gas, the *Shenandoah* on her recent trip to St. Louis, dove down near the ground and was then pulled to earth by some 300 men, a method not always applicable. If 90 per cent of the water-vapor could be recovered, there would be no loss of weight of the ship.

The purification of helium is also one of the great problems in the industry, Dr. Lind said. The best method is that used in repurification of the gas at the Lakehurst station, where it is passed over activated charcoal at the temperature of liquid air, resulting in the absorption by the charcoal of all gases except helium and hydrogen. This results in nearly 100 per cent helium. Airships are now using a mixture of 90 per cent helium and 10 per cent nitrogen, he said.

Other important sources of helium gas besides the gas wells of the Dallas-Fort Worth district are known to the government, Dr. Lind stated, but their location and extent are being kept military secrets. When the industry is more developed and the needs of the Army and Navy are fully met, the surplus supply of the gas will be released for commercial purposes. At present the military uses absorb the entire output.

Dr. Moore, during further discussion, emphasized the unique military value of helium, saying that this country contains all the known world supply and that as an asset in time of war such a resource is invaluable and should be carefully conserved."—*Literary Digest.*

Target Practice of Batteries A and B, 51st Coast Artillery

By Captain G. H. Ericson, C. A. C.

These practices are of interest because of the fire control system used; and also as they show adaptability of the 155-mm. G. P. F. guns to the positive system of coast defense and that rapid indirect fire can be effectively delivered on moving targets.

The first series of practices was held at Fort Eustis and the second at Fort Monroe. At the former station, the battery was placed in position under cover of woods, with 200 yards between platoons thus affording additional protection. The center line of fire was so laid that the main parts of the channel and part of the shore line were included in the field of fire of the battery and entirely within the traverse of each gun. Each platoon had a separate directing point and covered the same field of fire. No part of the field of fire could be observed from the battery position, nor was it possible for the battery commander to obtain an observing point near the position. Observation both for range and deflection was therefore dependent on advanced observing points. All fire was indirect.

From this battery position seven practices were conducted, one at a land target, two at selected points in the sea area and four at moving water targets. The range for all water targets varied from 12,000 to 13,000 yards, the normal powder charge being used.

A description of the methods used for observation of fire and locating the target follows. The base-end observing points used for tracking the target were towers located at the shore line, approximately 4000 yards in front of the battery position. The distance between them was about 8800 yards, thus providing a base line of adequate length. The target was tracked by the horizontal base system, using the Cloke plotting board. Observation of fire was had from the base-end observation points, also, the spotters obtaining the deviation of the shot, or of the center of impact of salvos, only. The spotters used B. C. instruments. This data was transmitted to the plotting room where the actual deviations in range and azimuth were obtained by means of the Cole Spotting Board.

During calibration and trial fire, the deviation of single shots was reported by the spotters. For the firing at the moving target, the deviation of the center of impact of the salvo was reported.

The rate of fire, after trial fire had been completed was four salvos per minute, in each salvo the four guns firing simultaneously. Not more than eight salvos were fired in a series as a precaution to eliminate danger of hitting small vessels.

The second series of practices was fired at Fort Monroe, Va. The battery marched from Fort Eustis in accordance with a prepared schedule. There is nothing special to note relative to the march.

The battery position here was on the beach in front of one of the fixed batteries. It was exposed and the field of fire entirely visible from the guns. Five practices were conducted from this position using direct fire for the practices at the shorter ranges and indirect fire for those at the longer ranges. The first of the series was for calibration, all the others were fired at a moving target. The practice of May 24th was fired per schedule of exhibitions for the Centennial Celebration of the Coast Artillery School. The ranges varied from 6000 to 16,000 yards, the last two practices being held at ranges from 9000 yards and greater, the super charge being used. It was necessary to use indirect fire at ranges over 10,000 yards, the target being too poorly defined through the gun sights for direct aiming.

The method of locating and plotting was the same as in practices held at Fort Eustis. The spotters were also located in the base-end observation points, from which they reported the deviation. The lateral and longitudinal deviations were obtained from the Cole spotting board except at the shorter ranges where the lateral deviation was obtained from an observation point at the battery. Difficulty was experienced in spotting at the 16,000 yards range due to the small splash made by the projectile and fire adjustment at that range was laborious. Supplemental observation was furnished by airplane at several of the practices. Deviations reported by the aerial observer and those determined by spotting section agreed very closely.

The rate of fire was four salvos per minute, and as many as twenty salvos were fired in a series. Even for the longest series, the guns did not heat excessively, and with alternate men handling the shot tray, this rate can be maintained by well trained gun crews for longer periods.

The practices satisfactorily demonstrated:

a. That the 155-mm. G. P. F. gun is a decidedly important auxiliary weapon in Coast Defense.

b. That efficient and rapid fire can be sustained for a considerable length of time, without undue wear of materiel.

c. That efficient fire can be delivered by indirect laying; and the guns can be emplaced in well concealed and protected positions.

d. That the limit of the field of fire of the battery (limit of traverse of each gun 60°) can be extended by emplacing the guns of a battery by platoons, each platoon covering adjacent areas. This does not complicate the system of fire control. With a battalion the field of fire may be further extended.

e. That fire at the extreme ranges of the gun can be sustained at a rapid rate.

f. That the computing devices used for obtaining firing data were adequate and capable of operation on 15-second intervals.

The efficiency of the 155-mm. G. P. F. guns depends on ability to observe the target, ability to observe burst or splashes during fire and the state of training of the personnel. The guns, carriages and gun equipment, except the sight, meet the requirements of this weapon in coast defense. The training of personnel for fire control is not being given proper attention, particularly in Tractor Artillery. The numerous motor vehicles, communication equipment as well as the fire control apparatus and armament proper require highly trained operators. Sufficient time for training in all of these subjects is not provided. This training is so important that *practically the entire morning period, daily* should be devoted to Artillery training, and that no special duty or detail, except guard, should interfere with the attendance of *any man* during this drill period. The limited allowance of

gasoline prohibits adequate individual training of motor vehicle drivers, road marches and the occupation of different firing positions during target practices. This allowance should be materially increased.

Airplane Superchargers

A new turbine supercharger for airplanes has been designed and built specifically for extreme altitude operation. It is rated to feed sea level atmospheric pressure to the engine at a height of 35,000 feet, or about twice the rating of the one used in the previous American altitude flight.

The supercharger consists of a turbine compressor mounted just back of the propeller blades of the plane on the front end of the Liberty motor and is operated from the red hot exhaust gases from the airplane motor, which ordinarily go to waste. It weighs about 140 pounds which might be considered a handicap in altitude flying but for the fact that at 35,000 feet its operation will increase the power of the Liberty motor by at least 280 horsepower, or about two horsepower for each additional pound carried.

A supercharged plane at 1000 feet, making 126 miles per hour, can make about 150 miles at altitudes over 20,000 feet, whereas a plane without a supercharger can make 131 miles at 1000 feet, but only 70 miles per hour at 20,000 feet. This shows that although there is a small loss in speed at low altitudes, there is a decided gain when flying at great heights.

The new supercharger has a rated speed of 33,000 r. p. m., but in tests it has been operated up to 41,000 r. p. m., or 683 turns of the compressor wheel a second, a speed probably greater than ever before attained in any commercial machine.—*General Electric Review,* January, 1924.

World's Largest Floating Dock

The huge floating dock for Southampton, building at the Walker shipyard of Sir W. G. Armstrong, Whitworth and Company, is reported to be approaching completion and may be ready for delivery next month. It will be the largest structure of its kind in the world and quite dwarf the monster floating docks which were confiscated from Germany after the war. While each of these had an overall length of about 700 feet and a lift of 40,000 tons, the Southampton dock is 960 feet in length and has a lifting capacity of 60,000 tons. It is of the double-sided, self-docking sectional box type, and consists of pontoon and two parallel walls divided transversely into seven sections. When in position at Southampton it will be moored by four steel beams, 110 feet long, hinged at one end to the dock and at the other extremity to four dolphins of reinforced concrete.

Fourteen motor-driven centrifugal pumps are provided for pumping out the 80,000 tons of water necessary to submerge the dock, a process that will take about four hours. The dock has been under construction since November 22, 1922. Mr. Eyres-Monsell stated in Parliament last April that when this dock was completed we should possess three floating docks capable of taking the *Hood,* the other two being the ex-German structures mentioned above. It was added that all these docks could be passed through the Suez Canal. The rumor that one is to be sent out to Singapore and another to Malta has not been confirmed.—*United States Naval Institute Proceedings.*

Attention is invited to a letter from Lieut. Colonel H. C. Barnes, Executive Assistant to the Chief of Coast Artillery, which was received for publication too late to be included in that part of the JOURNAL which its source and importance warrant. This letter appears on page 374 and is a reply to Major E. J. Cullen's article in the September issue of the JOURNAL, entitled "The Functions of Coast Fortifications in the Positive System of Coast Defense."